

UNITED STATES DEPARTMENT OF COMMERCE National Oceanic and Atmospheric Administration

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Refer to NMFS No.: 2005/00124

February 16, 2006

Mr. Dave Wesley U.S. Fish and Wildlife Service Pacific Region 911 NE 11th Avenue Portland, Oregon 97232-4181

Mr. Robert E. Willis
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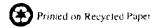
Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Caspian Tern Management Plan to Reduce Predation of Juvenile Salmonids in the Columbia River Estuary

Dare Bub

Dear Mr. Westey and Mr. Willis:

The enclosed document contains a biological opinion (Opinion) prepared by the National Marine Fisheries Service (NMFS) pursuant to section 7(a)(2) of the Endangered Species Act (ESA) on effects of the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers (the Federal Action Agencies) relocating Caspian terns from an existing nesting colony on East Sand Island in the Columbia River estuary by creating alternative nesting sites in Oregon and California. The purpose of the proposed action is to reduce tern predation on ESA-listed juvenile salmonids in the Columbia River estuary. In this Opinion, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of Upper Willamette River (UWR) spring-run Chinook salmon (Oncorhynchus tschawystcha), Central Valley (CV) spring-run Chinook salmon, Sacramento River (SR) winter-run Chinook salmon, Central California coast (CCC) steelhead (O. mykiss) or CV steelhead. Further, NMFS concludes that the proposed action is not likely to result in the destruction or adverse modification of critical habitat that NMFS has designated for UWR spring-run Chinook salmon, CV Chinook salmon, SR winter-run Chinook salmon, CCC steelhead, and CV steelhead.





As required by section 7 of the ESA, an incidental take statement prepared by NMFS is provided with the Opinion. The incidental take statement describes reasonable and prudent measures NMFS considers necessary or appropriate to minimize incidental take associated with this action. It also sets forth nondiscretionary terms and conditions, including reporting requirements, that the Federal Action Agencies must comply with to carry out the reasonable and prudent measures. Incidental take from actions by the Federal Action Agencies that meet these terms and conditions will be exempt from the ESA take prohibition.

This document also includes the results of our consultation regarding the action's likely effects on essential fish habitats (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and includes three conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects to EFH. These conservation recommendations are not an identical subset of the terms and conditions in the Opinion. Section 305(b)(4)(B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30-days after receiving these recommendations. If the response is inconsistent with the recommendations, the Federal Action Agencies must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the action and the recommendations.

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, in your statutory reply to the EFH portion of this consultation, we ask that you clearly identify the number of conservation recommendations accepted.

If you have questions regarding this consultation, please contact Robert Anderson, Fishery Biologist, in the Oregon Coast/Lower Columbia Habitat Branch of the Oregon State Habitat Office at 503.231.2226.

For

Sincerely,

D. Robert Lohn

Regional Administrator

Michael R Crous

cc: Ms. Dori Welch, BPA

Endangered Species Act-Section 7 Consultation Biological Opinion

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Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation

Caspian Tern Management Plan to Reduce Predation of Juvenile Salmonids in the Columbia River Estuary

Lead Action Agencies:

U.S. Fish and Wildlife Service and

U.S. Army Corps of Engineers

Consultation

Conducted By:

National Marine Fisheries Service

Northwest Region

Date Issued:

February 16, 2006

Issued by:

D. Robert Lohn

Regional Administrator

Fir Michael & Clouse

NMFS No.:

2005/00124

TABLE OF CONTENTS

| INTRODUCTION | 1 |
|--|-----|
| Background and Consultation History | 1 |
| Action Area | 6 |
| ENDANGERED SPECIES ACT | 7 |
| Biological Opinion | |
| Status of the Species and Critical Habitat | |
| Effects of the Action | |
| Effects on ESA-Listed Salmonids | |
| Effects of Predation | |
| Effects on Critical Habitat | |
| Cumulative Effects | |
| Conclusion | |
| Conservation Recommendations | |
| Reinitiation of Consultation | |
| Incidental Take Statement | |
| Amount or Extent of Take | |
| Reasonable and Prudent Measures | |
| Terms and Conditions | |
| Terms and Conditions | |
| MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT | 11 |
| EFH Conservation Recommendations | 12 |
| Statutory Response Requirement | |
| Supplemental Consultation4 | 13 |
| DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW | 45 |
| BATA CONDIT ACT BOCCHENTITION IN BIRE BIREZINIA (ILC.) | |
| LITERATURE CITED | 17 |
| APPENDIX A - Impact Methodologies for ESA-listed Salmonids 50 |) - |
| APPENDIX B - Fern Ridge Lake 57 | , _ |
| APPENDIX C - Brooks Island58 | } - |
| APPENDIX D - Hayward Regional Shoreline and Don Edwards NWR 59 | |

INTRODUCTION

The biological opinion (Opinion) and incidental take statement portions of this consultation were prepared by the National Marine Fisheries Service (NMFS) in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973, as amended (16 USC 1531, et seq.), and implementing regulations at 50 CFR 402. With respect to critical habitat, the following analysis relied only on the statutory provisions of the ESA, and not on the regulatory definition of "destruction or adverse modification" at 50 CFR 402.02.

The essential fish habitat (EFH) consultation was prepared in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 USC 1801, et seq.) and implementing regulations at 50 CFR 600.

The administrative record for this consultation is on file at the Oregon State Habitat Office in Portland, Oregon.

Background and Consultation History

On January 31, 2005, NMFS received a letter from the U.S. Fish and Wildlife Service (USFWS) and the U.S. Army Corps of Engineers (Corps) requesting formal consultation pursuant to section 7(a)(2) of the ESA, and EFH consultation pursuant to section 305(b)(2) of the MSA on the Caspian Tern Management Plan to Reduce Predation of Juvenile Salmonids in the Columbia River Estuary.

The USFWS and the Corps provided a biological assessment (BA) describing the proposed action and its potential effects with the letter. In the BA, the USFWS and the Corps determined the proposed action was likely to adversely affect the following ESA-listed species: Puget Sound (PS) Chinook salmon (O. tshawytscha), Hood Canal (HC) summer-run chum salmon (O. keta); Upper Willamette River (UWR) spring-run Chinook salmon; Central Valley (CV) spring-run Chinook salmon, Sacramento River (SR) winter-run Chinook salmon, Central California coast (CCC) coho salmon (O. kisutch), CV steelhead (O. mykiss), and CCC steelhead. The USFWS and the Corps determined that the proposed action would have no effect on UWR steelhead. Based on information developed during formal consultation, NMFS determined that the data regarding the presence of CCC coho salmon within the San Francisco Bay River basins indicates that no adult CCC coho salmon have been detected during annual stream surveys since 1995. Central California coast coho salmon are considered to be extirpated from the San Francisco Bay River basins (West Coast Salmon Biological Review Team Report 2003) (BRT) and are not addressed further in the Opinion.

The action area includes designated critical habitat for UWR spring-run Chinook salmon, CV spring-run Chinook salmon, SR winter-run Chinook salmon, CCC steelhead, and CV steelhead.

The USFWS and the Corps also found the proposed action may adversely affect designated EFH for Chinook salmon, coho salmon, pink salmon, 44 groundfish species, and five coastal pelagic species.

On November 30, 2005, NMFS received a letter from the USFWS and the Corps revising the January 31, 2005, proposed action. In the letter, the USFWS and the Corps proposed to:

- 1. Withdraw the Dungeness National Wildlife Refuge (NWR) habitat management site due to concerns regarding the magnitude of predation on PS Chinook salmon and HC summer-run chum salmon. Therefore, these two species will not be considered further in this consultation.
- 2. Complete monitoring to track Caspian tern diet and nesting success at each habitat management site considered in this Opinion.

In 1984, Caspian terns established a nesting colony on East Sand Island, river mile (RM) 5 on the Columbia River, on a portion of the dredged material disposal site used in 1983. The colony moved to Rice Island (RM 21) in 1986. An estimated 1,000 pairs of Caspian terns were present at that time (Corps 2000, Roby et al. 2003 as cited in USFWS 2005a and USFWS 2005b). By 1998, the Caspian tern colony at Rice Island had attained an estimated population level of approximately 8,700 pairs (Collis et al. 2002, Roby et al. 2002 as cited in USFWS 2005a and USFWS 2005b). The 2003 population estimate for Caspian terns in the Columbia River estuary was 8,325 pairs. The nesting population of Caspian terns in the Columbia River estuary represents approximately two-thirds of the Pacific Coast regional population, and is the largest colony of Caspian terns in the world (Collis et al. 2003 as cited in USFWS 2005a and USFWS 2005b).

For many of the ESA-listed species migrating through the Columbia River estuary, tern predation is considered one of the primary limiting factors affecting juvenile survival (Fresh *et al.* 2004 as cited in USFWS 2005a and USFWS 2005b). In 1997, the Oregon Cooperative Fish and Wildlife Research Unit and associates initiated research into the Columbia River estuary Caspian tern population and their diet. Estimates of juvenile salmonid consumption for 1997 and 1998 were 8.1 and 12.4 million fish, respectively, or approximately 73% of the diet of Caspian terns at Rice Island (Roby *et al.* 2003 as cited in USFWS 2005a and USFWS 2005b). These estimates represented a substantial portion of the out-migrant population of juvenile salmonids from some ESA-listed species reaching the Columbia River estuary (Roby *et al.* 2003 as cited in USFWS 2005a and USFWS 2005b).

The results of the research prompted Federal resource managers to design a pilot project to relocate the Caspian tern colony from Rice Island to East Sand Island to reduce Caspian tern predation on ESA-listed juvenile salmonids in the Columbia River estuary.

On February 16, 1999, NMFS issued an Opinion on the Caspian Tern Relocation Pilot Project in the Columbia River Estuary. The pilot project was designed to reduce habitat on Rice Island in

an attempt to relocate nesting Caspian terns to East Sand Island. Incidental take for this action is covered under the February 16, 1999 Opinion.

On September 15, 1999, NMFS issued an Opinion to the Corps for the Columbia River Channel Operations and Maintenance Dredging Program. The Opinion required the Corps to modify habitat on Rice Island to eliminate nesting habitat for Caspian terns. Since 2001, no Caspian terns have nested on Rice Island resulting in reduced predation of juvenile salmonids from 11.7 million fish in 1999 to 6.5 million fish in 2002.

Although the overall magnitude of predation on ESA-listed salmonids by Caspian terns has decreased by 55% as a result of habitat modification actions taken on Rice Island, the level of predation by Caspian terns on ESA-listed salmonids in the Columbia River estuary remains one of the limiting factors impeding recovery of ESA-listed salmonids in the Columbia River basin [see Appendix C of the joint U.S. Army Corps of Engineers/USFWS/NMFS Final Environmental Impact Statement (FEIS)] (USFWS 2005a).

The Corps (et al. 2004) proposed measures to further reduce the impact of Caspian terns on ESA-listed salmonids in the Columbia River estuary in the updated proposed action (UPA) for the Federal Columbia River Power System (FCRPS). In the UPA, under Predator Control Actions, Section III.D.1, the Bonneville Power Administration, the Corps, and the Bureau of Reclamation proposed to implement an additional Caspian tern management action to further reduce predation of ESA-listed juvenile salmonids in the Columbia River estuary consistent with the joint U.S. Army Corps of Engineers/USFWS/NMFS FEIS on the Caspian tern management plan (i.e., to reduce suitable Caspian tern nesting habitat on East Sand Island from 6.5 acres to 1.5-1.0 acres).

The Bonneville Power Administration, the Corps, and the Bureau of Reclamation committed to monitor and evaluate the response to the proposed management action and to submit annual reports to NMFS. Performance metrics include annual Caspian tern predation rates on juvenile salmonids and estimates of the resulting juvenile survival rates. The Caspian tern relocation proposal is expected to further reduce the terns' future annual consumption of juvenile ESA-listed salmonids in the Columbia estuary to an estimated 1.63 to 2.03 million smolts from the current annual average of 5.9 million ESA-listed salmonids. In combination, these habitat management activities in the Columbia River estuary are expected to contribute to an increase in population growth rates ≥ 1% for the four ESA-listed steelhead species in the Columbia River basin.

The present Opinion only evaluates the effects of relocation/habitat management activities outside of the Columbia River estuary, and did not evaluate Caspian tern-related activities for salmon and steelhead in the Columbia River estuary addressed in the FCRPS Opinion (NMFS 2004a).

Proposed Action

For purposes of this consultation, the proposed action is to maintain and enhance existing Caspian tern nesting habitat and create and maintain new Caspian tern nesting habitat with socialization and predator control measures at Fern Ridge Lake, Oregon; and Brooks Island, Hayward Regional Shorelines and Don Edwards NWR in San Francisco Bay, California in an effort to relocate the East Sand Island Caspian tern population in the Columbia River estuary. The proposed reduction in habitat on East Sand Island would occur only after nesting habitat is created/enhance elsewhere in the region. Thus, habitat enhancement in the region and reduction in habitat on East Sand Island would be phased in at a 2:1 ratio. Approximately 7 acres of habitat would be managed in Oregon and California. This includes habitat management site in Oregon where there are no ESA-listed species under NMFS' jurisdiction. The proposed action includes a total of four management sites: Fern Ridge Lake in Oregon; and Brooks Island, Hayward Regional Shorelines, and Don Edwards NWR in San Francisco Bay (Table 1).

Table 1. Proposed Caspian Tern Habitat Management Sites Considered in this Consultation

| Potential Caspian Nesting Sites | Proposed Management Action | Projected Available Acreage | Projected Caspian Tern Colony |
|--|--|-----------------------------------|-------------------------------------|
| Oregon | | | |
| Fern Ridge Lake | Construct one island near Gibson Island, and social facilitation. | 1 acre | 600 birds |
| California | | | |
| Brooks Island, Central San Francisco Bay | Remove exotic vegetation, social facilitation, predator control, gull harassment or control, shoreline protection, and public use management and outreach. | 2 acres | 3000 birds |
| Hayward Regional Shoreline | Substrate enhancement, social facilitation, predator control, and gull harassment or control. | 0.5 acre | 3000 birds |
| Ponds N1/N9, Don Edwards NWR, San Francisco Bay | Substrate enhancement, social facilitation, predator control, and gull harassment or control. | 0.5 – 1 acre | 3000 birds |

Fern Ridge Lake, Oregon

The USFWS and the Corps propose to construct a 1-acre island to provide nesting habitat for Caspian terns at Fern Ridge Lake. Island construction would occur during the fall and winter. Existing roads would be used to access the site during the construction period.

The proposed island would be square with side dimensions of approximately 208.7 feet (ft). A total of 12,092 cubic yards (cy) of rock and sand will be used to construct the island, and consist

of 8,872 cy would of quarry rock, 807 cy of 1.5 inch minus rock, 800 cy of rip rap, and 1,613 cy of sand.

Future operation and maintenance required to maintain Caspian tern nesting habitat at the Fern Ridge Lake Island is likely. Surface materials (sand) may require periodic replenishment due to wind erosion. The USFWS and the Corps would control vegetation using mechanical or chemical treatments. Chemical treatments would consist of spot application of the herbicide Rodeo®. Presently, Caspian terns do not nest at this site. The USFWS and the Corps propose to create nesting habitat to support a population of 600 birds.

San Francisco Bay, California

Three locations are proposed for habitat development, enhancement, and maintenance to support additional nesting Caspian terms in the San Francisco Bay area. The locations are Brooks Island, Hayward Regional Shorelines, and Don Edwards NWR.

Brooks Island

The activities proposed at Brooks Island include vegetation management and nesting habitat enhancement. Vegetation removal would include manual or mechanical treatment for removal of non-native plants to provide a bare surface for nesting. Substrate enhancement would likely include the addition of sand, pea gravel, or other suitable material for nesting Caspian terns. Future operation and maintenance requirements to maintain Caspian tern nesting habitat at Brooks Island is likely. Presently, the Caspian tern colony at this site has an eight-year arithmetic mean of 1,452 birds (USFWS 2005a). The Caspian tern colony was 2,080 birds in 2004. The USFWS and the Corps propose to enhance nesting habitat to support a population of 3,000 birds, an increase of 920 additional birds.

Hayward Regional Shorelines

The activities proposed at Hayward Regional Shorelines would include vegetation management and substrate enhancement on two of the existing islands within Hayward Ponds (islands two, six, and seven). These islands lie within salt pond retention dikes and are not directly connected to San Francisco Bay. The ponds are tidally influenced, but the tidal effect is muted due to the dikes.

Vegetation management would include mechanical, manual or chemical treatments for removal of non-native plants to provide a bare surface for nesting. Substrate enhancement would likely include the addition of sand, pea gravel, or other suitable material for nesting Caspian terns. Future operation and maintenance requirements to maintain Caspian tern nesting habitat at the Hayward Regional Shorelines site is likely. The USFWS and the Corps propose to enhance nesting habitat to support a population of 3,000 birds.

The USFWS and the Corps propose to conduct avian research at Hayward Regional Shoreline if the Caspian tern colony reaches a size identified in the FEIS Adaptive Management and Monitoring Plan that would trigger research actions (i.e., 1,000 birds). Presently, Caspian terns at this site have a 7-year arithmetic mean of two birds (USFWS 2005a).

Don Edwards National Wildlife Refuge

The activities proposed on Don Edwards NWR would include vegetation management and substrate enhancement on existing islands within Ponds N1/N9. These islands lie within salt pond retention dikes and are not directly connected to San Francisco Bay. Vegetation management would include mechanical, manual, or chemical treatments for removal of nonnative plants to provide a bare surface for nesting. Substrate enhancement would include vegetation management to provide a bare surface and the addition of sand, pea gravel or other suitable material for nesting Caspian terms. No Caspian terms have ever nested at this site. The USFWS and the Corps propose to create nesting habitat to support a population of 3,000 birds. Future operation and maintenance requirements to maintain Caspian term nesting habitat at the Don Edwards NWR site is likely. All construction activities would occur between November and March of a given year.

Adaptive Management Plan

- 1. As a result of withdrawing the Dungeness NWR habitat management site, the USFWS and the Corps propose an adaptive management plan to manage the acres of suitable nesting habitat on East Sand Island at 1.5 to 2 acres instead of 1 to 1.5 acres.
- 2. The USFWS will implement a regional monitoring plan for the Pacific coast/western regional Caspian tern population, and the Corps will implement colony and diet monitoring at all habitat management sites considered in this Opinion. As part of the adaptive management plan, Caspian tern nesting habitat acreage on East Sand Island could be reduced to 1 acre if terns initiate nesting on a suitable site in the future.
- 3. The USFWS and the Corps will initiate Caspian tern diet studies at each habitat management site after Caspian tern colonies reach 75% of the full projected colony size identified in the BA for two consecutive years. Diet studies would follow standardized protocols currently used at Dungeness NWR, East Sand Island, and San Francisco Bay sites and would be implemented for a three-year period to factor in annual fluctuations in tern numbers and salmonid consumption. Annual reports will be submitted to NMFS.
- 4. The USFWS and the Corps will monitor and annually report: (1) Number of nesting terns at each managed alternate site considered in this Opinion, and if diet studies are triggered; (2) the percent of salmonids in the diet, the fish consumption rate, and productivity estimates.

Action Area

'Action area' means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). For purposes of this

consultation, the action area is comprised of four 18-mile circular areas centered on each of the four Caspian Tern colony sites, and for the UWR spring-run Chinook salmon species, includes an 18-mile radius centered on East Sand Island in the Columbia River estuary. This 18-mile Caspian tern foraging radius is based on information in USFWS 2005a and USFWS 2005b. The four habitat management sites considered in this Opinion are: Fern Ridge Lake, Oregon; and Brooks Island, Hayward Regional Shoreline, and Don Edwards NWR in California.

The action areas are used by juvenile and adult salmon and steelhead (Table 2) and includes designated critical habitat for, UWR spring-run Chinook salmon, CV spring-run Chinook salmon, SR winter-run Chinook salmon, CCC steelhead, and CV steelhead. It is also designated EFH for Chinook salmon, coho salmon, 44 groundfish species, and five coastal pelagic species.

Table 2. Federal Register notices for final rules that list species, designate critical habitat, or apply protective regulations to species considered in this consultation. (Listing status: 'T' means listed as threatened under the ESA; 'E' means listed as endangered.

| Species | Listing Date | Critical Habitat Designation | Protective Regulations |
|--|--|---------------------------------|---------------------------|
| Chinook salmon (O. tshawytscha | <u> </u> | | <u> </u> |
| Upper Willamette River spring-run Chinook salmon | T 3/24/99; 64 FR 14308; T 6/28/05; 70 FR 37160 | 09/02/05; 70 FR 52630 | 6/28/05; 70 FR 37160 |
| Central Valley spring-run Chinook salmon | T 9/16/99 64 FR 50394; T 6/28/05; 70 FR 37160 | 09/02/05; 70 FR 52488 | 6/28/05; 70 FR 37160 |
| Sacramento River winter-run Chinook salmon | E 11/30/90; 55 FR 49623; T 1/1/94; 59 FR 440; E 6/28/05; 70 FR 37160 | 6/16/93 58 FR 33212 | ESA Section 9 applies |
| Steelhead (O. mykiss) | | | |
| Central California coast steelhead | T 8/18/97 62 FR 43937; E 6/28/05; 70 FR 37160 | 5/5/99; 64 FR 24049 | ESA Section 9 applies |
| Central Valley steelhead | T 3/19/98 63 FR 13347 | 09/02/05; 70 FR 52488 | 7/10/00; 65 FR 42481 |

ENDANGERED SPECIES ACT

The ESA establishes a national program to conserve threatened and endangered species of fish, wildlife, plants, and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with USFWS and NMFS as appropriate, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their critical habitats. Section 7(b)(4) requires the provision of an incidental take statement that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts.

Biological Opinion

This Opinion presents NMFS' review of the status of each listed species of Pacific salmon and steelhead considered in this consultation, the condition of designated critical habitat, the environmental baseline for the action area, all the effects of the action as proposed, and cumulative effects (50 CFR 402.14(g)). For the jeopardy analysis, NMFS analyzes those combined factors to conclude whether the proposed action is likely to appreciably reduce the likelihood of both the survival and recovery of the affected listed species.

The critical habitat analysis determines whether the proposed action will destroy or adversely modify critical habitat for listed species by examining any change in the conservation value of the essential features of that critical habitat. This analysis relies on statutory provisions of the ESA, including those in section 3 that define "critical habitat" and "conservation," in section 4 that describe the designation process, and in section 7 setting forth the substantive protections and procedural aspects of consultation. Furthermore, this Opinion follows agency guidance for the application of the "destruction of adverse modification" standard of the ESA section 7(a)(2) (Memorandum, W. Horgarth, November 7, 2005).

Status of the Species and Critical Habitat

This section defines range-wide biological requirements of each species and reviews the status of the species relative to those requirements. The present risk faced by each species informs NMFS' determination of whether additional risk will 'appreciably reduce' the likelihood that a specieswill survive and recover in the wild. The greater the present risk, the more likely any additional risk resulting from the proposed action's effects on the population size, productivity [growth rate (lambda λ)], distribution, or genetic diversity of the species will be an appreciable reduction (McElhaney *et al.* 2000).

Status of the Species. The NMFS reviews the range-wide status of the species affected by the proposed action using criteria described in NMFS' Viable Salmonid Populations and the Recovery of ESUs document (VSP) (McElhaney et al. 2000). Attributes associated with a VSP include abundance, productivity, spatial structure, and genetic diversity to enhance a species' capacity to adapt to various environmental conditions and allow it to become self-sustaining in the natural environment. These attributes are influenced by survival and behavioral experiences throughout the entire life cycle, characteristics that are influenced in turn by habitat and other environmental conditions.

To be considered viable, with a negligible risk of extinction due to threats from demographic variation, local environmental variation, and genetic diversity changes over the long term, a species should have the following characteristics. It should contain multiple populations so that a single catastrophic event is less likely to cause the species to become extinct, and so that the

¹ "An 'evolutionarily significant unit' (ESU) of Pacific salmon (Waples 1991) and a 'distinct population segment' (DPS) of steelhead (final steelhead FR notice) are considered to be 'species,' as defined in Section 3 of the ESA."

species may function as a "metapopulation" as necessary to sustain population-level extinction/recolonization processes. Multiple populations within a species also increase the likelihood that a diversity of phenotypic and genotypic characteristics will be maintained, thus allowing natural evolutionary processes to operate and increase the species' long-term viability.

Some of the species populations should be relatively large and productive to further reduce the risk of extinction in response to a single catastrophic event that affects all populations. If a species consists of only one population, that population must be as large and productive ("resilient") as possible. Some populations in each species should be geographically widespread to reduce the risk that spatially-correlated environmental catastrophes will drive the species to extinction. Other populations in the same species should be geographically close to each other to increase connectivity between existing populations and encourage metapopulation function. Populations with diverse life-histories and phenotypes should be maintained in each species to further reduce the risk of correlated environmental catastrophes or changes in environmental conditions that occur too rapidly for an evolutionary response, and to maintain genetic diversity that allows natural evolutionary processes to operate within a species. Finally, evaluations of species status should take into account uncertainty about species-level processes. Our understanding of species-level spatial and temporal processes is limited such that the historical number and distribution of populations serve as a useful goal in maintaining viability of species that likely were historically self-sustaining.

Role of Recent Ocean Conditions in Species Status. In the last decade, evidence has shown recurring, decadal-scale patterns of ocean-atmosphere climate variability in the North Pacific Ocean. These oceanic productivity 'regimes' have correlated with salmon population abundance in the Pacific Northwest and Alaska. Survival rates in the marine environment are strong determinants of population abundance for Pacific salmon and steelhead. However, because the confidence with which ocean-climate regimes can be predicted into the future is limited, the ability to project the future influence of ocean-climate conditions on salmonid productivity is limited. Even under the most optimistic scenario, increases in abundance might be only temporary and could mask a failure to address underlying factors for decline. It is reasonable to assume that salmon populations have persisted over time under pristine conditions through many such cycles in the past. Less certain is how the populations will fare in periods of poor ocean survival when their freshwater, estuary, and nearshore marine habitats are degraded (NMFS 2004b).

On August 12, 2005, NMFS' Northwest Fisheries Science Center issued a memorandum regarding the biological implications of recent ocean conditions in coastal waters of Oregon and Washington. The memo reports unusually low numbers of juvenile salmon in coastal waters of Oregon and Washington. When coupled with increases in water temperatures and clarity (indicating poor primary productivity that deviates markedly from long-term averages), those observations suggest returns of adult salmon may be lower than expected starting this fall (coho salmon), and may continue have implications for both coho and Chinook salmon returns over the next several years.

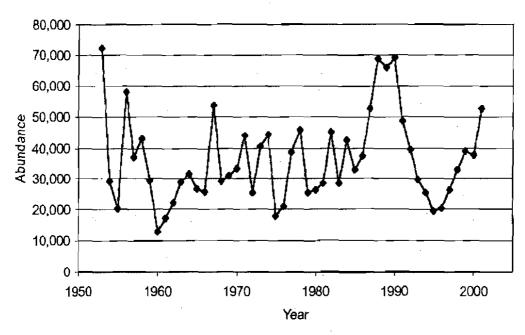
The NMFS is not certain of the full biological implications for Pacific salmon production over the next few years. The NMFS is relatively certain that responses are likely to vary by species and stock.

UWR Spring-Run Chinook Salmon

Species Structure. The Willamette/Lower Columbia River TRT (McElhany et al. 2004) identified seven demographically independent populations of UWR spring-run Chinook salmon in a single major group. All of these populations are extant, although they vary in degree of viability. For the UWR spring-run Chinook salmon species, NMFS determined that the McKenzie and Middle Fork Willamette River populations were the only populations within the species likely to be affected by the proposed action due to their geographic proximity to Fern Ridge Lake, and rearing and migration strategies and growth and development characteristics of juvenile spring-run Chinook salmon in the Willamette River action area (all populations).

Abundance and Trends. The total number of spring-run Chinook salmon spawners passing Willamette Falls from 1953 to 2001 is shown in Figure 1. In 2003 and 2004, more than 100,000 adult spring-run Chinook salmon crossed Willamette Falls each year. The average run size in the last 50 years has been around 40,000, with peaks as low as 11,000. A large fraction of fish passing the falls are of hatchery origin. The largest run on record was 156,033 adults in 1953 (Oregon Department of Fish and Wildlife 2000b as cited in NMFS 2004a). The 2003 escapement estimate for this species was 51,091 (arithmetic maximum).

Figure 1. Counts of spring-run Chinook salmon (hatchery and natural-origin) passing Willamette Falls.



McKenzie Subbasin Population. Spring-run Chinook salmon are native to the McKenzie River basin. Historical natural spawning areas included the mainstem McKenzie River, Smith River, Lost Creek, Horse Creek, South Fork, Blue River, and Gate Creek (Mattson 1948; Parkhurst et al. 1950 as cited in NMFS 2004a). Currently, the McKenzie subbasin supports the largest existing population of UWR spring-run Chinook salmon. Downstream from Leaburg Dam, most spring-run Chinook salmon spawners are hatchery-produced (Corps 2000 as cited in NMFS 2004a). Spring-run Chinook salmon escapement to Leaburg Dam has varied over the last 30 or more years, with the 1988 through 1991 runs the strongest recorded. However, until 2001, it was difficult to distinguish naturally-produced spawners from hatchery-origin fish, so these data may not represent the status of the wild population over time.

Lindsay (2003 as cited in NMFS 2004a) reported in 2002, that 55% of the spring-run Chinook salmon carcasses in the South Fork McKenzie below Cougar Dam and in the mainstem McKenzie between Leaburg Dam and the Carmen-Smith spawning channel were wild fish. Historical spawning areas included the mainstem McKenzie River, Smith River, Lost Creek, Horse Creek, South Fork, Blue River, and Gate Creek (Mattson 1948; Parkhurst *et al.* 1950 as cited in NMFS 2004a). It has been estimated that historically there was suitable habitat for 80,000 fish in the McKenzie River subbasin (Parkhurst *et al.* 1950 as cited in NMFS 2004a). Construction of Cougar Dam at RM 4.5 on the South Fork McKenzie River in 1963 blocked access to at least 25 miles of high quality spawning habitat. The South Fork was considered the best spring-run Chinook salmon production area in the McKenzie basin (USFWS 1948 as cited in NMFS 2004a). The 2002 escapement estimate for the McKenzie River population of spring-run Chinook salmon was 4,788 (arithmetic maximum) (Ferman *et al.* 2005).

Middle Fork Willamette River Population. Historically, the Middle Fork Willamette River spring-run Chinook salmon run may have been the largest in the Upper Willamette basin (Hutchison 1966; Thompson et al. 1966 as cited in NMFS 2004a). There was an estimated minimum run size of approximately 7,100 adult spring-run Chinook salmon for the area that is now above Lookout Point Dam (Corps 2002 as cited in NMFS 2004a). This estimate does not include fish that spawned downstream from the hatchery rack (such as in the mainstem Middle Fork Willamette River below Dexter and in the Fall Creek watershed). Mattson (1948 as cited in NMFS 2004a) estimated a run size of 2,550 naturally-produced spring-run Chinook salmon to the Middle Fork Willamette River in 1947. USFWS (1962 as cited in NMFS 2004a) reported that approximately 450 spring-run Chinook salmon spawned above the site of Fall Creek Dams in the years immediately before construction (the project was completed in 1966). Currently, the naturally spawning population of spring-run Chinook salmon in the Middle Fork Willamette subbasin is very small and probably is made up mostly of the progeny of hatchery fish that were released to spawn in the wild.

There is no estimate of the population growth rate or productivity for naturally spawning spring-run Chinook salmon in the Middle Fork Willamette subbasin. Lindsay (2003 as cited in NMFS 2004a) reported that 4% of the spring-run Chinook salmon carcasses collected between Jasper and Dexter and in Fall Creek below the dam were wild fish. From 1953 through 1966 (after the construction of Dexter and Lookout Point dams blocked access to the historical spawning

grounds), an average of 3,502 Chinook salmon were caught in the trap at the base of Dexter Dam (Corps 2000 as cited in NMFS 2004a). These total counts probably included some hatchery-origin fish. Thompson *et al.* (1966 as cited in NMFS 2004a) estimated a total population of 6,100 naturally and artificially-produced adults in the Middle Fork Willamette subbasin in the mid-1960s. Firman *et al* (2002 as cited in NMFS 2004a) estimated a natural-origin run of spring-run Chinook salmon to the Middle Fork Willamette subbasin of 987 fish in 2002, based on counts of naturally-spawned carcasses and the number of unmarked fish taken for hatchery broodstock at Dexter Dam. It appears that the Middle Fork Willamette subbasin does not currently support a self-sustaining population of naturally-produced spring-run Chinook salmon. Natural spawning occurs in the mainstem Middle Fork Willamette below Dexter Dam, although ODFW investigations indicated that warm water temperatures cause eggs to succumb to fungus infections, and those eggs that do survive produce juveniles that emerge early (Ziller *et al.* 2002 as cited in NMFS 2004a).

Juvenile UWR spring-run Chinook salmon occur in the Willamette River throughout the entire Caspian tern nesting season.

Central Valley Spring-run Chinook Salmon

Species Structure. Extant CV spring-run Chinook salmon populations in the southern Cascades ecoregion include those in Mill, Deer, and Butte Creeks (BRT 2003). Spring-run populations of the northern Sierra ecoregion are found in the Yuba and Feather Rivers. The Feather River population is thought to depend on the Feather River Hatchery (FRH) spring-run artificial propagation program, which may also influence the Yuba River population.

The BRT Findings. All three spring-run Chinook salmon populations have long- and short-term $\lambda > 1$ (λ is defined as exp (μ + σ 2 p / 2)—the mean annual population growth rate in this document), with lower bounds of 90% confidence intervals generally > 1. Long- and short-term trends are also positive, although some confidence interval lower bounds are negative CV spring-run Chinook salmon have some of the highest population growth rates in the Central Valley, but other than Butte Creek and the hatchery-influenced Feather River, population sizes are relatively small compared to fall-run Chinook salmon populations.

The CV spring-run Chinook salmon species had been reduced from an estimated peak of 700,000 spawners species-wide to a range of 67 to 243 spawners per population by the mid-1980s (NMFS 2004b). Only three out of 18 historical spring-run populations still exist. All of the San Joaquin River basin spring-run populations have been extirpated by the loss of their habitat, high water temperatures, and lack of flows (NMFS 2004b).

2004 Status Review. The loss of upper-basin spawning and holding habitats due to dam construction and environmental degradation has resulted in the extirpation of most CV spring-run populations, reducing species abundance, productivity, spatial structure, and diversity. Genetic risks lie in possible hybridization between straying FRH spring-run with local native stocks. There are two evolutionarily distinct groups of CV spring-run (Hedgecock 2002 as cited in BRT

2003). The southern Cascades populations are more closely related to each other than to their fall-run conspecifics. The northern Sierra spring-run are more closely related to their respective fall-run conspecifics than to other spring-run populations in the species, similar to the evolutionary pattern demonstrated in the Klamath-Trinity basin. Species spatial structure has been reduced through the extirpation of 15 extant populations, including all spring-run populations in the San Joaquin River basin.

Recent Counts and Returns to the Spawning Grounds. More recent population estimates (years 2001-2003) for upper Sacramento River spring-run indicate increasing abundance for the Mill Creek (1,426), Deer Creek (2,759), and Butte Creek (4,398) populations (BRT 2003). The 2003 estimates of spring-run in streams dependent upon migration from adjacent populations range from 25 to 94 fish (NMFS 2004b). The long- and short-term trends for spring-run growth have been positive over the past five years (NMFS 2004b). The 2003 escapement estimate was 6,068.

Juvenile CV spring-run Chinook salmon occur in San Francisco Bay throughout the entire Caspian tern nesting season.

Sacramento River Winter-Run Chinook Salmon

Species Structure. This species consists of a single population composed of both natural-origin and hatchery-origin fish. Critical habitat for winter-run Chinook salmon was designated on June 16, 1993 (58 FR 33212), and includes the Sacramento River from Keswick Dam (RM 302) downstream to Chipps Island (RM 0) at the westward margin of the Sacramento-San Joaquin Delta; all waters from Chipps Island westward to the Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait; all waters of San Pablo Bay west of the Carquinez Bridge; and all waters of the San Francisco Bay (north of the San Francisco Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. SR winter-run Chinook salmon originally were listed as threatened in November 1990 (55 FR 46515) and then reclassified as endangered in January 1994 (59 FR 440), due to the increased variability of run sizes, expected weak returns as a result of two small year classes in 1991 and 1993, and a 99% decline between 1966 and 1991.

Proposed recovery plan for SR winter-run Chinook salmon. In August 1997, NMFS released its Proposed Recovery Plan for the SR winter-run Chinook salmon that included delisting criteria developed by the Sacramento River Winter-run Chinook Salmon Recovery Team of a population growth rate (geometric mean cohort replacement rate) of ≥ 1.0 and an abundance target of $\geq 10,000$ female spawners.

Recent Counts and Returns to the Spawning Grounds. The estimated 2003 escapement for SR winter-run Chinook salmon was 2,191. Recent winter-run Chinook salmon abundance represents only 3% of the maximum post-1967, five-year geometric mean and is not yet well established (NMFS 2004b).

In the Sacramento River basin, spring-run Chinook salmon reportedly emigrate from March through June, and from November through March, while fall-run Chinook salmon emigration occurs from March through July (Yoshiyama *et al.* 1998 as cited in BRT 2003). Emigrating juveniles in the upper Sacramento River reportedly are greater than 2.8 inches in size. Fry greater than 2.8 inches reportedly have been observed rearing in the Sacramento-San Joaquin estuary for 2 months before entering ocean (Myers *et al.* 1998 as cited in BRT 2003). Chinook salmon fry emigrants reportedly range from 1.2 to 1.8 inches in fork length and fingerling emigrants range from 2 to 4.7 inches in fork length (Healey 1991 as cited in BRT 2003).

The winter-run Chinook salmon species was originally composed of several populations that historically spawned in the headwaters of the McCloud, Pit, and Little Sacramento Rivers and Hat and Battle Creeks. A winter-run population that existed in the Calaveras River in the San Joaquin basin in the 1970s and 1980s has since been extirpated. Construction of Shasta Dam blocked access to all winter-run habitat in the upper watershed except for Battle Creek, a tributary of the Sacramento River (NMFS 2004b). Most of the current winter-run Chinook salmon spawning and rearing habitat is between Keswick Dam and Red Bluff Diversion Dam in the Sacramento River.

2004 Status Review. Species productivity has been positive in the short term, and adult escapement and juvenile production have been increasing annually (NMFS 2004b). The long-term trend for the species remains negative, as it consists of only one population, subject to possible catastrophic impacts from environmental and artificial conditions.

Juvenile SR winter-run Chinook salmon occur in San Francisco Bay throughout the entire Caspian tern nesting season.

Central California Coastal Steelhead

Species Structure. The CCC steelhead species includes all naturally-spawned populations of steelhead in accessible river and tributary reaches within watershed basins from the Russian River (Sonoma County) to Aptos Creek, in Santa Cruz County (inclusive) and the drainages of San Francisco and San Pablo Bays eastward to the Napa River (inclusive) in Napa County, California. Also included in the species are the artificially propagated steelhead stocks (and their progeny) at the Don Clausen Fish Hatchery and the Monterey Bay Salmon and Trout Project Kingfisher Flat Hatchery (BRT 2003).

A status review update conducted in 1997 (NMFS 1997 as cited in BRT 2003), concluded that slight increases in abundance occurred in the three years following the status review, but the analyses on which these conclusions were based had various problems, including inability to distinguish hatchery and wild fish, unjustified expansion factors, and variance in sampling efficiency on the San Lorenzo River. Presence/absence data compiled by Adams (Southwest Fisheries Science Center, personal communication as cited in BRT 2003) indicated that most (82%) sampled streams (a subset of all historical steelhead streams) had extant populations of juvenile steelhead.

The BRT believed that artificial propagation contributed to population abundance, but members were unsure of hatchery effects on the unknown productivity, spatial structure, and diversity of the species.

2004 Status Review. A few tributaries in the southern San Francisco estuary historically supported steelhead runs, but the effects of urbanization have resulted in the extirpation of several native fish species, including steelhead (NMFS 2004b). Currently, only four watersheds in the south bay support small populations of steelhead. More recent information includes a presence/absence compilation of steelhead in the CCC species, indicating that 82% of the sample streams across the species held O. mykiss juveniles (NMFS 2004b). Statistical analysis conducted on the available juvenile data estimated a downward trend for five independent sites: the San Lorenzo River and Scott, Waddell, Gazos, and Redwood Creeks. Habitat for this species has been impacted by the major passage barriers of Coyote and Warm Springs dams in the Russian River watershed, urban development, poor land-use management, and irrigation and water diversion impacts (NMFS 2004b).

Recent Counts and Returns to the Spawning Grounds. The 2003 escapement estimate for CCC steelhead was 5,662. There are no adequate abundance estimates for the Russian River, Scott Creek, and San Lorenzo River systems (NMFS 2004). Juveniles are reportedly widespread and abundant in the Russian River, Scott Creek, and the San Lorenzo River systems, but it is not known if productivity is at a viable level for species recovery (NMFS 2004b). For purposes of estimating the impact of predation on CCC steelhead, NMFS subtracted the last known low-end escapement estimate (1994, BRT 2003) of CCC steelhead in the Russian River as the Russian River does not drain into San Francisco Bay. Therefore, for purposes of estimating the impact of predation on this species, NMFS used an escapement estimate of 3,912.

Juvenile CCC steelhead occur in San Francisco Bay throughout the entire Caspian tern nesting season.

Central Valley Steelhead

Species Structure. The CV steelhead species includes all naturally-spawned populations of steelhead and their progeny in the Sacramento and San Joaquin Rivers and their tributaries, excluding steelhead from the San Francisco and San Pablo Bays and their tributaries. The species also includes artificially-propagated steelhead stocks and their progeny from the Coleman National Fish Hatchery and Feather River Hatchery programs. Other anadromous hatchery steelhead stocks propagated within but not included in the species are those in the Nimbus Hatchery (Eel River stock) and the Mokelumne River Hatchery (out-of-basin composite stock) steelhead programs.

Current Abundance. Abundance of the CV steelhead species was estimated at 40,000 fish in the 1960s, but estimates were reduced to less than 10,000 fish by 1992, based on past spawning surveys, hatchery returns, and dam counts (NMFS 2004b). CV steelhead populations show a continuing population decline, an overall low abundance, and fluctuating return rates

(BRT 2003). In the assessment of the species, two-thirds of the BRT members voted for the category "in danger of extinction," and the remaining members voted for the "likely to become endangered" category (BRT 2003). The BRT expressed concerns about the increasing risks of the effects of artificial propagation on species abundance, productivity and spatial structure and the moderate but increasing risk to species abundance.

To estimate the mean and variance of Cw/Ch, the trawl data sets were re-sampled with replacement 1,000 times. The mean Cw/Ch ranged from 0.06 to 0.30, and coefficients of variation ranged from 16% to 37% of the means. From such calculations, it appears that about 100,000-300,000 steelhead juveniles (roughly, smolts) are produced naturally each year in the Central Valley. Making the fairly generous assumptions (in the sense of generating large estimates of spawners) that average fecundity is 5,000 eggs per female, 1% of eggs survive to reach Chipps Island, and 181,000 smolts are produced (the 1998-2000 average), about 3,628 female steelhead spawn naturally in the entire Central Valley. This can be compared with McEwan's (2001 as cited in BRT 2003) estimate of 1 to 2 million spawners before 1850, and 40,000 spawners in the 1960s.

Another source of information comes from screw trap operations at Knights Landing on the lower Sacramento River, just above the confluence of the Feather River (Snider and Titus 2000a, 2000b, 2000c as cited in BRT 2003). From 1995-1999, estimates of the natural production for the areas above Knights Landing averaged 9,800 yearling steelhead outmigrants (range 7260-11,700). This level of production is about 5% of the total production as estimated above, and may be a substantial underestimate due to application of trap efficiency estimates generated from recaptures of marked Chinook salmon juveniles, which probably are less able to avoid traps.

The CV steelhead abundance was estimated to be 40,000 fish in the 1960s, but estimates were reduced to less than 10,000 fish by 1992, based on past spawning surveys, hatchery returns, and dam counts (NMFS 2004b). CV steelhead populations show a continuing population decline, an overall low abundance, and fluctuating return rates (BRT 2003). In the assessment of the species, two-thirds of the BRT members voted for the category "in danger of extinction," and the remaining members voted for the "likely to become endangered" category (BRT 2003). The BRT expressed concerns about the increasing risks of the effects of artificial propagation on species abundance, productivity and spatial structure and the moderate but increasing risk to species abundance.

2004 Status Review. Steelhead have been extirpated from most of their historical range in the Central Valley and have continued to decline over the past 25 years. They are impacted by a lack of suitable spawning habitat and poor quality habitat overall (NMFS 2004b). The loss of upper basin spawning habitats and limited productivity in large river source populations has affected genetic diversity (NMFS 2004b). This is reflected in recent genetic bottlenecks in populations throughout the Central Valley. There is a high gene flow among natural and hatchery populations in the upper Sacramento River, influenced by confined lower basin steelhead distribution and hatchery management.

Recent Counts and Returns to the Spawning Grounds. The 2003 escapement estimate CV steelhead was 7,256. All indications are that natural CV steelhead have continued to decrease in abundance and in the proportion of natural to hatchery fish over the past 25 years (BRT 2003), and the long-term trend remains negative (NMFS 2004b). There has been little steelhead population monitoring, despite 100% marking of hatchery steelhead since 1998. Hatchery production and returns are dominant over natural fish and include significant numbers of out-of-basin, non-species-origin steelhead.

Juvenile CV steelhead occur in San Francisco Bay throughout the entire Caspian tern nesting season.

Status of Critical Habitat. The NMFS reviews the status of critical habitat affected by the proposed action by examining the condition and trends of primary constituent elements (PCEs) throughout the designated area. PCEs consist of the physical and biological elements identified as essential to the conservation of the species in the documents identifying critical habitat (Table 3).

Table 3. Types of sites and essential physical and biological features designated as PCEs, and the species life stage each PCE supports.

| Site | Essential Physical and Biological Features | Species Life Stage |
|------------------------|--|--|
| Freshwater spawning | Water quality, water quantity, and substrate | Spawning, incubation, and larval development |
| Freshwater rearing | Water quantity and floodplain connectivity | Juvenile growth and mobility |
| | Water quality and forage | Juvenile development |
| | Natural cover ^a | Juvenile mobility and survival |
| Freshwater migration | Free of artificial obstructions, water quality and quantity, and natural cover | Juvenile and adult mobility and survival |
| Estuarine areas | Free of obstruction, water quality and quantity, and salinity | Juvenile and adult physiological transitions between salt and freshwater |
| | Natural cover, a forage, b and water quantity | Growth and maturation |
| Nearshore marine areas | Free of obstruction, water quality and quantity, natural cover, and forage b | Growth and maturation, survival |
| Offshore marine areas | Water quality and forage ^b | Growth and maturation |

a Natural cover includes shade, large wood, log jams, beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

b Forage includes aquatic invertebrate and fish species that support growth and maturation.

PCEs consist of the physical and biological elements identified as essential to the conservation of the species in listing and recovery documents. These PCEs include sites essential to support one or more life stages of each species (sites for spawning, rearing, migration and foraging) and contain physical or biological features essential to the conservation of each species, for example, spawning gravels, water quality and quantity, side channels, and forage species.

The specific type of sites and essential physical and biological features most relevant to this Opinion are freshwater rearing sites and estuarine areas. The PCE, forage, is the only essential biological feature affected by the proposed action.

All species considered in this Opinion have designated critical habitat that includes areas within the Willamette River, Columbia River estuary, or San Francisco Bay. The present condition of PCEs within proposed or designated areas and the human activities that affected PCE trends are described below in the environmental baseline.

Environmental Baseline

The 'environmental baseline' includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02). For projects that are ongoing actions, the effects of future actions over which the Federal agency has discretionary involvement or control will be analyzed as 'effects of the action.'

The NMFS describes the environmental baseline in terms of the biological requirements for habitat features and processes necessary to support life stages of the subject species within the action area. When the environmental baseline departs from those biological requirements, the adverse effects of a proposed action on the species or its habitat are more likely to jeopardize the ESA-listed species or result in destruction or adverse modification of a critical habitat (NMFS 1999).

The biological requirements of salmon and steelhead in the action area vary depending on the life history stage present and the natural range of variation present within that system (Groot and Margolis 1991, NRC 1996, Spence *et al.* 1996). Each species considered in this Opinion resides in or migrates through the four action areas. Thus, for these action areas, the biological requirements for salmon and steelhead are the habitat characteristics that would support successful growth, development, and physiological adaptation to marine waters, and rearing/migration and migration PCEs.

<u>Caspian Tern Biology.</u> Caspian tern biology is discussed in this section for informational purposes as it relates to their biology, habitat requirements, and diet and foraging behaviors. The NMFS does not have regulatory jurisdiction over Caspian terns, which are a protected species under the Migratory Bird Treaty Act.

Species Range. Caspian terns breed at widely-scattered sites across North America. Wires and Cuthbert (2000 as cited in USFWS 2005a and USFWS 2005b) described five disjunct breeding regions in North America. Caspian terns breeding in the Columbia River estuary are in the Pacific Coast/Western Pacific Coast region. This region includes coastal Alaska, southwestern British Columbia, Washington, Oregon, California, Baja California, and Sinaloa, Mexico; and interior Washington, Oregon, California, southern Idaho, Montana, Wyoming, western Nevada, and northern Utah.

Pacific Coast Region Overview. Since the beginning of the 20th century, the Pacific Coast regional population has shifted from nesting in numerous small colonies associated with freshwater marshes in interior California and southern Oregon, to primarily larger colonies along the coast extending into the state of Washington (Gill and Mewaldt 1983 as cited in USFWS 2005a and USFWS 2005b). Caspian terns adapt to spatial and temporal variability of breeding habitat and prey, leading to highly variable colony locations and sizes within the region. In recent years, terns were documented to have nested on about 60 sites scattered throughout the Pacific Coast region, including Alaska. This habitat base serves as a network of sites, which individually may vary in suitability from one year to the next, but collectively provide a suite of locations for terns on a regional scale. Colonies in the interior are characteristically small in size and are subject to substantial shifts in location, quantity, and quality corresponding to cycles of flood and drought. Interior sites may also be subject to intensive management such as the control of reservoir and irrigation water. Larger colonies (e.g., hundreds to thousands of terns) have been documented primarily along the Pacific Coast. Nesting along the Pacific coast typically occurs from April through August (Table 4).

Table 4. Nesting Periods of Caspian Terns Oregon and California

| | April | May | June | July | August |
|------------|-------|--|-------------------|--|--------|
| Oregon | | | rites | | |
| California | | District Control of Co | de Carly Brains & | Constitution of the consti | |

Coastal nesting habitat can be managed or natural and is typically subject to erosion and vegetation changes over time. Although ocean conditions may affect prey availability, coastal prey resources are typically more diverse, abundant, and stable in comparison to prey resources at interior sites which are highly variable from year-to-year.

Habitat Requirements. Caspian terns nest in single-species colonies or in multi-species assemblages with other ground nesting waterbirds (e.g., gulls, skimmers, other terns, cormorants). Caspian terns breed in a variety of habitats ranging from coastal estuarine, salt marsh, and islands. Terns typically nest in open, barren to sparsely vegetated areas, but also among or beside driftwood, partly buried logs, rocks, or tall annual weeds. Nest substrates vary from sand, gravel, spongy marshy soil, or dead or decaying vegetation to hard soil, shell banks,

limestone, or bedrock. Nests range from simple depressions in a bare substrate to nests lined with debris, such as shells, crayfish chelipeds, dried grasses and weed stems, wood or pebbles.

Diet and Foraging Range. Breeding terns eat fish almost exclusively, catching a diverse array of species with shallow plunge dives, usually completely submerging themselves underwater (Cuthbert and Wires 1999 as cited in USFWS 2005a and USFWS 2005b). The average foraging distance from the colony of terns during the breeding season on East Sand Island was observed to range from 8 to 13 miles (USFWS 2005a and USFWS 2005b). Average foraging distance increased to 18 miles during the post-fledging period (USFWS 2005a and USFWS 2005b).

The sizes of fish caught and diet composition is largely determined by geography and annual and seasonal prey availability, but most fish are between 1.9 to 9.8 inches and occur near the surface of the water. In the Columbia River estuary, diet studies of the tern colonies on Rice and East Sand islands documented that terns nesting on Rice Island (1999 to 2000) had an average of 83 (77 to 90%) juvenile salmonids in their diet (Roby *et al.* 2002 as cited in USFWS 2005a and USFWS 2005b), while on East Sand Island (1999 to 2004), terns had an average of 33 (17 to 47%) juvenile salmonids in their diet (Collis *et al.* 2002a, 2002b, 2003a, 2003b, K. Collis pers. comm. as cited in USFWS 2005a and USFWS 2005b). From 1999 to 2003, the tern diet on East Sand Island, closer to the mouth of the Columbia River than Rice Island, was primarily non-salmonids, including northern anchovy, herring, shiner perch, sand lance, sculpins, smelt, and flatfish (Roby *et al.* 2002, Collis *et al.* 2002b and 2003a as cited in USFWS 2005a and USFWS 2005b). As ocean conditions improved, and thus, ocean productivity, the percentage of juvenile salmonids in the diet of terns in the estuary has continued to decline in recent years.

Salmonid composition at other study sites was found to be variable. For example, in Grays Harbor, Washington, chum and coho salmon comprised 14 to 21% of the Caspian tern diet while the rest of the diet was primarily shiner perch and northern anchovy (Penland 1976 as cited in USFWS 2005a and USFWS 2005b). At Dungeness NWR, salmonid composition of the tern diet was observed to be the second most important prey species averaging 31% of tern diet over the nesting season in 2004 (Roby et al. 2004 as cited in USFWS 2005a and USFWS 2005b). Both of these sites in Washington differ from that observed in Commencement Bay, a location south of Dungeness NWR in Puget Sound, Washington. In 2000, terns in Commencement Bay were observed to have an average of 52% salmonids in their diet (Thompson et al. 2002 as cited in USFWS 2005a and USFWS 2005b). It is possible that these observed differences in diet composition is because Grays Harbor and Dungeness NWR contain a greater diversity and/or abundance of marine prey species than found in Commencement Bay due to the adjacent marine waters in these two locations.

In San Francisco Bay, diet studies conducted in 2003 and 2004, found that the tern diet varied among the various nesting locations in the bay, but primary prey species included anchovy, surf perch, silversides, herring, sunfish, gobies, and toadfish (Roby *et al.* 2003a and 2004 as cited in USFWS 2005a and USFWS 2005b). In 2003, salmonids (not including trout from reservoirs) were found in the diets of four out of five nesting colonies, ranging from 0.1% (Agua Vista Park

and Baumberg Pond) to 8.7% (Knight Island) of prey items (Roby et al. 2003a as cited in USFWS 2005a and USFWS 2005b). In 2004, juvenile salmonids were more prevalent in the tern diets, ranging from 1.4% (Agua Vista Park) to 26.1% (Knight Island), and were assumed to be non-ESA-listed species (Roby et al. 2004 as cited in USFWS 2005a and USFWS 2005b). The higher prevalence of salmonids in the tern diet was apparently due to a lower availability of marine fish during that year (e.g., northern anchovy and surfperch, Roby et al. 2004 as cited in USFWS 2005a and USFWS 2005b).

In interior Oregon (Summer and Crump Lakes), a study conducted in 2003 found tui chubs to be the primary prey of nesting terns (Roby *et al.* 2003a as cited in USFWS 2005a and USFWS 2005b). In San Diego, food habits of terns were studied in 1995, 1997, and 1998. These studies consistently found terns to feed primarily on sardines, anchovies, and topsmelt (Horn *et al.* 1996, Horn and Dahdul 1998 and 1999 as cited in USFWS 2005a and USFWS 2005b).

Migration. Caspian terns migrate singly or in groups that can be as large as thousands (Shuford and Craig 2002 as cited in USFWS 2005a and USFWS 2005b). Most terns congregate for migration at traditional foraging locations along marine coasts and major rivers or freshwater lakes about a month after young have fledged (Shuford and Craig 2002 as cited in USFWS 2005a and USFWS 2005b). Timing of migration varies with region; fall movement typically occurs between mid-July and mid-September along the Pacific Coast (Shuford and Craig 2002 as cited in USFWS 2005a and USFWS 2005b).

Fern Ridge Lake, Oregon.

Habitat. In general, human influences associated with forestry, farming, grazing, road construction, mining, and urbanization have all contributed to the decline of the listed salmonids and their habitat. A significant majority of the historical habitat for UWR species has been eliminated by dams (NMFS 2000). The remaining habitat available for anadromous fish occurs primarily in the lowland areas of the Willamette Valley. Most of the valley floor is privately-owned and has been converted to agricultural use, with Douglas-fir and Oregon white oak stands present in less-developed areas (NMFS 2000). Irrigation is commonly employed, and stream flows, especially in the southern portion of this region, can be significantly affected. Agricultural and livestock practices contribute to soil erosion and fertilizer/manure deposition into stream systems.

Channel alterations (bank hardening, channel down-cutting, dredging, and isolating sloughs with cut-off dams) have resulted in the simplification of the once highly braided river system (NMFS 2000). From 1870 to 1950, over 65,000 snags and streamside trees were pulled and cut up along the mainstem Willamette River (NMFS 2000). This removal of woody debris represented an average of 550 snags per 0.6 miles. The average size of these snags ranged between 98 to 197 feet in length and 1.6 to 6.6 feet in diameter, with the cottonwoods the largest at up to 164 feet long and 6.6 feet in diameter.

Water quality impacted by agricultural and urban activities are exacerbated by low water flows and high temperatures during the summer. Pulp and paper mill discharges of dioxin into the Columbia and Willamette Rivers were cited as another water quality concern. Agricultural and urban operations have led to increases in pesticides, nutrients, trace elements, and organic compounds in the streams where anadromous fish reside. In addition, a 6-mile stretch of the Lower Willamette River near Portland has been proposed as a Federal Superfund site by the Environmental Protection Agency.

In the early 1920s, water tests by local and state agencies indicated that much of the lower Willamette River was heavily polluted by both municipal and industrial (primarily pulp and paper industries) wastes. A 1929 survey concluded that during summer low flow conditions, the dissolved oxygen levels in the lower Willamette River dipped to levels at or below 0.5 parts per million (NMFS 2000). Furthermore, these conditions continued for an additional 30 years before there was any detectable improvement in water conditions (NMFS 2000).

Historically, spring-run Chinook salmon populations existed in the smaller subbasins of the Willamette, such as the Molalla, Pudding, Thomas Creek, Crabtree Creek, Wiley Creek, Coast Fork, and Row River (NMFS 2000). Habitat loss and degradation are the primary factors leading to the extinction of these natural-origin populations and currently limit the reestablishment Chinook salmon in these areas (NMFS 2000). However, in the future, with substantially reduced harvest rates and improved artificial propagation techniques, reintroduction into these habitats might be feasible.

Due to the significant changes in habitat quality discussed above, the fish community has changed dramatically in the Willamette River basin. A U.S. Geological Survey study of water quality in the Willamette River basin found fish community conditions that were characteristic of degraded and polluted systems and ranked among the poorest 25% of streams sampled in the U.S. by the National Water Quality Assessment program (NMFS 2000). At one of the agricultural sites sampled in this study (Molalla River subbasin), 99% of the fish were non-native, pollution tolerant species and 61% of the fish exhibited external anomalies (NMFS 2000).

Forage Species. Designated critical habitat for UWR spring-run Chinook salmon in the Willamette River and the Columbia River estuary includes the forage PCE. Juvenile UWR spring-run Chinook salmon in the Willamette River forage on macroinvertebrates. In Oregon's 2004 Water Quality Assessment Section 305(b) Report (ODEQ 2004), the Willamette River basin had the highest number stream kilometers in poor condition for aquatic life use of any of the basins assessed with 43% of the stream kilometers evaluated rating poor for the biological indicator macroinvertebrate community. While there is no comprehensive assessment of forage species in the Columbia River estuary, limited food resources were not identified as a factor for decline or a limiting factor for recovery in the BRT's Updated Status Review of Federally-Listed ESUs of West Coast Salmon and Steelhead (BRT 2003). Juvenile UWR spring-run Chinook salmon in the Columbia River estuary forage primarily on macroinvertebrates, although larger juveniles may opportunistically forage on fishes in the estuary, such as anchovy. However,

consumption of fish by UWR spring-run Chinook salmon typically does not occur until they reach the Pacific Ocean where they forage on fishes in the Columbia River plume.

Natural Conditions. Salmon and steelhead are exposed to high rates of natural predation, particularly during freshwater rearing and migration stages. Ocean predation may also contribute to significant natural mortality, although the levels of predation are largely unknown. In general, salmonids are prey for pelagic fishes, birds, and marine mammals, including harbor seals, sea lions, and killer whales. There have been recent concerns that the rebound of seal and sea lion populations, following their protection under the Marine Mammal Protection Act of 1972, has resulted in substantial mortality for salmonids. In recent years, for example, sea lions have learned to target UWR spring-run Chinook salmon in the fish ladder at Willamette Falls (NMFS 2004b).

Changes in the abundance of salmonid populations are also substantially affected by the general pattern of a 30-year decline in ocean productivity. The mechanism whereby stocks are affected is not well understood. The pattern of response to these changing ocean conditions has differed among stocks, presumably due to differences in their ocean timing and distribution. It is presumed that survival is driven largely by events occurring between ocean entry and recruitment to a sub-adult life stage.

Water Quality. Clean Water Act 303(d) list parameters within the action area for Oregon (ODEQ 2002) include mercury, fecal coliform, temperature, and turbidity.

Summary. The Upper Willamette River basin has undergone substantial anthropogenic changes in the last 150 years. Loss of access to the majority of the historical spring-run spawning grounds due to dam construction, channelization of the mainstem Willamette River, and degradation in river water quality (especially in the Willamette Valley) has lead to the decline in anadromous fish populations in the basin. Although the amount of available spawning habitat was reduced by the construction of dams, the remaining habitat is largely unsuitable due to the thermal and hydrological characteristics of the water discharged from the base of the dams.

Naturally spawning late-run winter steelhead exist in a number of major and minor tributaries to the Willamette River. Populations exist in the North and South Santiam River basins, with a remnant population in the Calapooia River. Additionally, there is a population in the Molalla River, although this may be descended from hatchery fish introduced from the North Santiam Hatchery. Small spawning aggregations of unknown origin also exist in the Pudding and Tualatin Rivers. The loss of or degradation in their spawning, rearing, and holding habitat similarly affects spring-run Chinook salmon.

Given all the factors for decline, even taking into account the corrective measures being implemented, it is clear that the biological requirements of UWR spring-run Chinook salmon salmon, including habitat-related parameters and population factors, are currently not being met under the environmental baseline.

San Francisco Bay, California.

The history of human activities, present environmental conditions, and factors contributing to the decline of salmonids listed under the ESA. Profound alterations to the estuarine environment of San Francisco Bay began with the discovery of gold in the middle of the 19th century. Dam construction, water diversion, hydraulic mining, and the diking and filling of tidal marshes soon followed, launching San Francisco Bay into the era of rapid urban development and coincident habitat degradation.

Habitat. Since the 1850s, land use activities associated with urban development and industrial development have altered fish habitat quantity and quality. In the past 150 years, urbanization has resulted in the diking and filling of tidal marshes. Industrial development has resulted in the construction of large docks and piers. These changes have reduced the acreage of wetlands and increased pollutant loadings to the San Francisco Bay estuary (NMFS 2003b as cited in USFWS 2005a and USFWS 2005b). Installation of docks, shipping wharves, marinas, and miles of rock riprap for shoreline protection have contributed greatly to the loss and degradation of shoreline and wetland habitat within the action area (NMFS 2003b as cited in USFWS 2005a and USFWS 2005b). These impacts have diminished the amount of suitable foraging habitat and cover for juvenile salmonids along shoreline and wetland areas.

Industrial, municipal, and agricultural wastes have been discharged into the waters of San Francisco Bay, with major historical point sources including wastes from fish, fruit, and vegetable canneries and municipal sewage. The large-scale pollution of San Francisco Bay estuary was partially relieved by the passage of the Clean Water Act in 1972, resulting in the construction of sewage treatment plants in all cities. Non-point sources of pollution, such as urban and agricultural runoff, continue to degrade water quality today. These contaminants may impair physiological development of juvenile salmonids that could reduce survival potential during the oceanic phase (NMFS 2003b as cited in USFWS 2005a and USFWS 2005b).

As native fish stocks became depleted in the late 19th century, non-native species were brought into the bay and delta, including American shad, striped bass, common carp, and white catfish. As their populations boomed, those of native fishes declined further. Introduction of non-native species accelerated in the 20th century through deliberate introductions of fish and unintended introductions of invertebrates through ballast water of ships. Establishment of non-native species was probably facilitated by altered hydrologic regimes and reduction in habitats for native species. The introduction and spread of non-native species in the San Francisco Bay estuary has affected native species, including listed salmonids, through competition for food and habitat, and predation on native species (NMFS 2003b as cited in USFWS 2005a and USFWS 2005b).

Forage Species. Designated critical habitat for CV spring-run Chinook salmon, SR winter-run Chinook salmon, CCC steelhead, and CV steelhead in San Francisco Bay includes the forage PCE. Juvenile salmonids in San Francisco Bay forage primarily on macroinvertebrates, although larger juveniles may opportunistically forage on fishes in the estuary, such as anchovy. While there is no comprehensive assessment of forage species in San Francisco Bay, limited food

resources were not identified as a factor for decline or a limiting factor for recovery in the BRT's Updated Status Review of Federally Listed ESUs of West Coast Salmon and Steelhead (BRT 2003). However, consumption of fish is likely limited and only constitutes a small fraction of the diet for CV spring-run Chinook salmon, CCC steelhead, and CV steelhead. SR winter-run Chinook salmon are likely too small to forage on fishes in San Francisco Bay.

Natural Conditions. The San Francisco Bay estuary provides migratory and rearing habitat for three Chinook salmon species and two steelhead species. Historically, portions of the estuary have also provided habitat for coho salmon. Factors for decline at the time of listing include urban development, flood control, water development, and other anthropogenic factors. The estuary is an intensively urbanized center for industry, agriculture and commerce.

Activities associated with road construction, urban and industrial development, flood control, and recreation have adversely affected the quantity and quality of salmonid spawning, rearing, and migratory habitats. Urbanization has resulted in severe and permanent impacts due to stream channelization, increased bank erosion, riparian damage, and pollution (NMFS 1996 as cited in USFWS 2005a and USFWS 2005b). Many streams have dams and reservoirs that mute flushing stream flows, withhold or reduce water levels suitable for fish passage and rearing, physically block upstream fish passage, and retain valuable sediments for spawning and rearing. Impaired stream reaches are vulnerable to further perturbation resulting from poor land use management decisions.

The pervasive negative effects of urbanization on watershed and riparian corridor functions have been documented by numerous researchers. Steiner Environmental Consulting (1996 as cited in USFWS 2005a and USFWS 2005b) cited Botkin *et al.* (1995 as cited in USFWS 2005a and USFWS 2005b) who determined that urbanization had degraded salmon habitat through stream channelization, floodplain drainage, and damage to riparian vegetation. Stream pollution is likely to increase with higher human density, degrading water quality for both people and wildlife (Florsheim and Goodwin 1993 as cited in USFWS 2005a and USFWS 2005b), as are the effects of urbanization are associated with lower fish species diversity and abundance (Weaver and Garman 1994 as cited in USFWS 2005a and USFWS 2005b).

Water Quality. Clean Water Act 303(d) list parameters within the action area include: (San Francisco Bay) chlordane, dichloro-diphenyl-trichloroethane (DDT), diazinon, dieldrin, dioxin compounds, exotic species, furan compounds, mercury, polychlorinated biphenyls (PCBs), and selenium; (Lower Bay) chlordane, DDT, diazinon, dieldrin, dioxin compounds, exotic species, furan compounds, mercury, nickel, and PCBs; and (South Bay) chlordane, DDT, diazinon, dieldrin, dioxin compounds, exotic species, furan compounds, mercury, PCBs, and selenium.

Summary. Significant steps towards the largest ecological restoration project yet undertaken in the United States have occurred during the past ten years in California's Central Valley. The CALFED Program and the Central Valley Project Improvement Act's Anadromous Fish Restoration Program, in coordination with other Central Valley and Bay area efforts, have

implemented habitat restoration actions including wetland restoration projects in the action area. Restoration of wetland areas typically involves flooding lands previously used for agriculture, thereby creating additional wetland areas and rearing habitat for juvenile salmonids, other fish species, and birds. Additional restoration efforts are ongoing or proposed for several watersheds in the estuary. Salmonid populations, however, remain depressed, and habitat in the action area has been decreased and degraded. The most recent status review update concludes that these species remain at risk of extinction.

Given all the factors for decline, even taking into account the corrective measures being implemented, it is clear that the biological requirements of CV spring-run Chinook salmon, SR spring-run Chinook salmon, CCC steelhead, and CV steelhead, including habitat-related parameters and population factors, are currently not being met under the environmental baseline.

Effects of the Action

'Effects of the action' means the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Effects of the action that reduce the ability of a listed species to meet its biological requirements may increase the likelihood that the proposed action will result in jeopardy to that listed species or in destruction or adverse modification of a designated critical habitat.

Effects on ESA-Listed Salmonids

The action, as proposed, is reasonably likely to result in direct and indirect effects on ESA-listed salmonids considered in this Opinion. Direct effects from the proposed action include: (1) A reduction in the abundance of juvenile ESA-listed salmonids, (2) reduced prey species for ESA-listed juvenile salmonids, and (3) construction-related effects (e.g., temporary increases in turbidity). Construction activities at Fern Ridge Lake, Oregon, would occur within an area that is inaccessible to ESA-listed salmonids. Therefore, NMFS expects construction-related effects at Fern Ridge Lake to be insignificant. Construction activities on Brooks Island would not occur within the water. Brooks Island is hydraulically connected to San Francisco Bay. However, construction activities are limited to grading and placement of sand and gravel, and would not occur below the mean higher high tide elevation. Construction activities at the Hayward Regional Shorelines and Don Edwards NWR sites would occur on islands within isolated ponds that have limited hydraulic connectivity with San Francisco Bay. Therefore, NMFS also expects construction-related effects at Brooks Island, Hayward Regional Shoreline, and Don Edwards NWR to be insignificant.

Indirect effects include the following: (1) Reductions in smolt-to-adult recruitment; (2) decreases in annual escapements; (3) decrease in ESA-listed salmonid population growth rates; (4) beneficial effects (reduced predation and increased survival rates for juveniles passing through the Columbia River estuary) for the UWR spring-run Chinook salmon species; and (5) effects associated with use of herbicides. The USFWS and the Corps did not provide any

specifications (e.g., formulation, application rate, surfactants, inactive ingredients, metabolites, adjuvants) regarding use of herbicides. However, the USFWS and the Corps did propose to reinitiate consultation prior to any vegetation-control treatment options that involve the use of herbicides. Therefore, this Opinion will not address herbicide-related effects.

Impact Methodologies for ESA-listed Salmonids. The NMFS developed a set of analytical methods (Appendices B through D) to estimate the magnitude of take on ESA-listed salmonids by Caspian terns at each habitat management site considered in this Opinion. These take-magnitude indices were then used to formulate estimates on reductions in smolt-to-adult recruitment and long-term reductions in ESA-listed salmonid productivity at five-year and 10-year intervals at the population, population group, and species scales. These take-magnitude indices were formulated using Caspian tern diet composition data in Roby et al. 2004.

Appendix A provides a description of the mathematical steps taken to calculate the respective cell-values. Appendices B through D show the mathematical outputs used to determine the magnitude of take and its impact on smolt-to-adult recruitment, decreases in annual escapements and decreases in productivity as a result of increased predation by Caspian terns on juvenile ESA-listed salmonids. These outputs are summarized and incorporated into the analysis in the section on Effects of Predation, below.

Impacts on smolt-to-adult recruitment, decreases in annual escapements and decreases in productivity at the five-year and 10-year intervals were estimated using a static-trend population analysis, instead of an age-structured Leslie matrix analysis (because data to parameterize the model were not available for the species considered in this Opinion) or a Passive Integrated Transponder (PIT) tag detection analytical technique similar to that used in Appendix C of the FEIS (USFWS 2005a) to determine effects on productivity for the four ESA-listed Columbia River basin steelhead species because no PIT tag data for the species considered in this Opinion is available. For purposes of this consultation, a static-trend population analysis is defined as a mathematical set of variables, e.g., reductions in smolt-to-adult recruitment and salmonid population estimates, that are fixed within the equation and are linearly adjusted to predict declines in spawner-to-spawner ratios and population trajectories, and assumes that impacts on population growth rates is independent of density and of changes in survival elsewhere in the salmonid life history.

VSP characteristics described in McElhany et al. 2000 for its analysis. These four key characteristics are: abundance, productivity/growth rate, spatial structure, and diversity. Population viability is defined based on a specified probability (i.e., 0.95) of persistence in 100 years. Abundance is the number of individuals in the population at a given life stage or time. Productivity or growth rate is the actual or expected ratio of abundance in the next generation to current abundance. Spatial structure refers to how the abundance at any life stage is distributed among available or potentially available habitats. Diversity is the variety of life histories, sizes, and other characteristics expressed by individuals within a population.

Structure and Assumptions used in Formulating the Effects Analysis by Species.

The following analysis of the impact on ESA-listed salmonids assumes that the proposed Caspian tern colonies are at the maximum number of birds assumed to colonize each habitat management site. For all species considered in this Opinion, the effects analysis was conducted at the individual, population, population group, and species scales as data allowed. The total salmonid percent diet estimate also assumes that a large fraction of salmonids consumed would be non-ESA-listed salmonids.

The take-magnitude indices formulated in Appendices B through D were run through a series of calculations (see Appendix A) to estimate reductions in smolt-to-adult recruitment and long term reductions in ESA-listed salmonid population growth rates at the five-year and 10-year intervals. Impacts at the one-year, five-year and 10-year intervals on escapement reduction and decreases in λ (spawner-to-spawner ratios or cohort replacement ratios) at the population and species scales are discussed below.

For the UWR spring-run Chinook salmon species, NMFS determined that the McKenzie and Middle Fork Willamette River populations were the only populations within the species likely to be affected (i.e., take of juveniles) by the proposed action due to their geographic proximity to Fern Ridge Lake, and rearing and migration strategies and growth and development characteristics of juvenile spring-run Chinook salmon in the Willamette River action area (all populations).

For the CV spring-run Chinook salmon, SR winter-run Chinook salmon, CCC steelhead, and CV steelhead, NMFS developed a relative abundance method, based on data from the BRT and sampling data from the CDFG in the Sacremento-San Joaquin Delta and San Francisco Bay, to estimate take at the individual and species scales. For Brooks Island and Hayward Regional Shorelines and Don Edwards NWR, recruitment impacts on these species were evaluated by geographic setting. For Brooks Island, an independent analysis was conducted based on geographic setting. For Hayward Regional Shorelines and Don Edwards NWR, the sites were combined for the purposes of an impact analysis as increased predation by Caspian terns on ESA-listed salmonids in San Francisco Bay would co-occur in space and time at these two sites.

Beneficial Effects. The Caspian tern management plan to reduce predation of juvenile salmonids in the Columbia River estuary by reducing suitable nesting habitat on East Sand Island from 6.5 acres to 1.5 to 2 acres will have a low (>0 - 2% increase in survival) benefit on the UWR spring-run Chinook salmon species (NMFS 2004a, Appendix E and USFWS 2005a, Appendix C). Potential survival increases for the UWR spring-run Chinook salmon species range from 2.3%, with a 0% compensatory mortality scenario to 0.6% with a 75% compensatory mortality scenario. This low level of benefit [long term (by 2014)] will accrue to all of the populations in the single major population group.

Effects of Predation

<u>UWR spring-run Chinook salmon.</u> Of the 22,286 juvenile salmonids likely to be consumed on an annual basis by Caspian terns at Fern Ridge Lake, an estimated 216 are likely to be juvenile UWR spring-run Chinook salmon. Of these, an estimated 180 are likely to be juvenile UWR spring-run Chinook salmon from the McKenzie River population, and 36 juvenile UWR spring-run Chinook salmon from the Middle Fork Willamette River population. Using data from ODFW (2002), total juvenile salmonid abundance in the Willamette River for 2004 was estimated at 5,138,214.

Annually, population growth rates (λ - spawner-to-spawner ratios or cohort replacement ratios) will decrease by 0.0365% to 0.0376% for Middle Fork Willamette and McKenzie populations, respectively. Based on the analysis in Appendix B, an annual reduction of 216 juvenile UWR spring-run Chinook salmon will result in escapement reductions of 0.36 adults (Middle Fork Willamette) to 1.8 adults (McKenzie River) at the 1% return rate, and 0.72 adults (Middle Fork Willamette) to 3.6 adults (McKenzie River) at the 2% return rate. Using the static-trend population analysis, five-year and 10-year population estimates were generated (Table 5). At the five-year interval, productivity will decrease between 0.182% and 0.188% at the population scale, with a species-scale decrease ranging from 0.004 % to 0.018% relative to the Middle Fork Willamette and McKenzie populations, respectively. At the 10-year interval, productivity will decrease from 0.365% to 0.376% at the population scale, with a species-scale decrease ranging from 0.014% to 0.070% relative to the Middle Fork Willamette and McKenzie populations, respectively.

Table 5. Static-trend Population Analysis at the Five-Year and 10-Year Intervals for the McKenzie River and Middle Fork Willamette River Populations of UWR spring-run Chinook Salmon at a 1% return rate.

| Population | Present Population Estimate | Escapement Reduction | 5-Year Escapement Reduction | Adjusted Population Estimate | Decrease in Population Productivity | Decrease in Species Productivity | 10-Year Escapement Reduction | Adjusted Population Estimate | Decrease in Population Productivity | Decrease in Species Productivity | Annual Decrease in Population Productivity |
|------------------|-----------------------------------|-------------------------|-----------------------------------|------------------------------------|---|---|------------------------------------|------------------------------------|---|--|--|
| McKenzie | 4788 | 1.8 | 9 | 4779 | 0.19% | 0.018% | 18 | 4770 | 0.376% | 0.070% | 0.0376% |
| MF Willamette | 987 | 0.36 | 1.8 | 985 | 0.18% | 0.004% | 3.6 | 981 | 0.365% | 0.014% | 0.0365% |

In summary, the McKenzie population and the Middle Fork Willamette population are unlikely to be at risk from increased predation by Caspian terns. At the five-year interval, productivity will decrease by 0.19% for the Middle Fork Willamette population to 0.18% for the McKenzie

population. At the 10-year interval, productivity will decrease by 0.365% for the Middle Fork population to 0.376% for the McKenzie population. At the five-year interval, productivity for this species will decrease by 0.004% to 0.018% at the 10-year interval. Decreases in productivity at the rates assumed in Table 5 are unlikely to appreciably diminish productivity for the McKenzie and the Middle Fork Willamette populations at the 10-year interval. Based on the analysis in Table 5, decreases in productivity at the five-year and 10-year intervals are unlikely to appreciably diminish productivity in the long term for UWR spring-run Chinook salmon at the population and species scales.

The significance of these productivity decreases is further reduced by the likely increased survival rates of these two populations passing through the Columbia River estuary due to the reduced Caspian tern predation rates resulting from this action.

CV spring-run Chinook salmon. Of the 114,960 juvenile salmonids likely to be consumed on an annual basis in San Francisco Bay, an estimated 311 are likely to be juvenile CV spring-run Chinook salmon. Based on data from the CDFG (2001a and 2001b), approximately 53,248,310 hatchery-produced salmonids (excluding rainbow trout) were released into the Sacramento and San Joaquin Rivers, and various locations throughout the Delta. Based on information from CDFG, approximately 55,938,310 juvenile salmonids were produced in the Sacramento-San Joaquin basins in 1999 (CFDG 2001a and CDFG 2001b).

Based on the analysis in Appendices C and D, an annual reduction of 311 juvenile CV spring-run Chinook salmon will result in escapement reductions of 3.11 adults at the 1% return rate to 6.22 adults at the 2% return rate. Using the static-trend population analysis, five-year and 10-year species abundance estimates were generated (Table 6). The population growth rate (λ - spawner-to-spawner ratios or cohort replacement ratios) will decrease annually by 0.0513% for the CV spring-run Chinook salmon species.

Table 6. Static-trend Population Analysis at the Five-Year and 10-Year Intervals for CV Spring-run Chinook Salmon at a 1% return rate.

| Species | Present Abundance Estimate | Escapement Reduction | 5-Year Escapement Reduction | Adjusted Species Estimate | Decrease in Species Productivity | 10-Year Escapement Reduction | Adjusted Species Estimate | Decrease in Species Productivity | Annual Decrease in Population Productivity |
|---------------------------------------|----------------------------------|-------------------------|-----------------------------------|---------------------------------|--|------------------------------------|---------------------------------|--|--|
| CV Spring-run Chinook salmon | 6068 | 3.11 | 15.55 | 6052 | 0.256% | 31.1 | 6037 | 0.513% | 0.0513% |

In summary, the CV spring-run Chinook salmon species is unlikely to be at risk from increased predation by Caspian terns. At the five-year interval, productivity for this species will decrease

by 0.256% to 0.539% at the 10-year interval. Based on the analysis in Table 6, decreases in productivity at the five-year and 10-year intervals are unlikely to appreciably diminish productivity in the long term for CV spring-run Chinook salmon at the species scale.

SR winter-run Chinook salmon. Of the 114,960 juvenile salmonids likely to be consumed on an annual basis by Caspian terns in San Francisco Bay, an estimated 30 are likely to be juvenile SR winter-run Chinook salmon. Based on data from the CDFG (2001a and 2001b), approximately 53,248,310 hatchery-produced salmonids (excluding rainbow trout) were released into the Sacramento and San Joaquin Rivers, and various locations throughout the Delta. Based on information from CDFG, approximately 55,938,310 juvenile salmonids were produced in the Sacramento-San Joaquin basins in 1999 (CFDG 2001a and CDFG 2001b).

Based on the analysis in Appendices C and D, an annual reduction of 30 juvenile SR winter-run Chinook salmon will result in escapement reductions of 0.30 adults at the 1% return rate to 0.60 adults at the 2% return rate. Using the static-trend population analysis, five-year and 10-year species abundance estimates were generated (Table 7). The population growth rate (λ - spawner-to-spawner ratios or cohort replacement ratios) will decrease annually by 0.0137% for the SR winter-run Chinook salmon species.

Table 7. Static-trend Population Analysis at the Five-Year and 10-Year Intervals for SR Winter-run Chinook Salmon at a 1% return rate.

| Species | Present Abundance Estimate | Escapement Reduction | 5-Year Escapement Reduction | Adjusted Species Estimate | Decrease in Species Productivity | 10-Year Escapement Reduction | Adjusted Species Estimate | Decrease in Species Productivity | Annual Decrease in Population Productivity |
|---------------------------------------|----------------------------------|-------------------------|-----------------------------------|---------------------------------|--|------------------------------------|---------------------------------|--|---|
| SR winter-run Chinook salmon | 2191 | 0.30 | 1.5 | 2189 | 0.069% | 3.0 | 2188 | 0.137% | 0.0137% |

In summary, the SR winter-run Chinook salmon species is unlikely to be at risk from increased predation by Caspian terns. At the five-year interval, productivity for this species will decrease by 0.069% to 0.137% at the 10-year interval. Based on the analysis in Table 7, decreases in productivity at the five-year and 10-year intervals are unlikely to appreciably diminish productivity in the long term for SR winter-run Chinook salmon at the population and species scales.

<u>CCC steelhead.</u> Of the 114,960 juvenile salmonids likely to be consumed on an annual basis by Caspian terns in San Francisco Bay, an estimated 200 are likely to be juvenile CCC steelhead. Based on data from the CDFG (2001a and 2001b), approximately 53,248,310 hatchery-produced salmonids (excluding rainbow trout) were released into the Sacramento and

San Joaquin Rivers, and various locations throughout the Delta. Based on information from CDFG, approximately 55,938,310 juvenile salmonids were produced in the Sacramento-San Joaquin basins in 1999 (CFDG 2001a and CDFG 2001b).

Based on the analysis in Appendices C and D, an annual reduction of 200 juvenile CCC steelhead will result in escapement reductions of 2.0 adults at the 1% return rate to 4.0 adults at the 2% return rate. Using the static-trend population analysis, five-year and 10-year population estimates were generated (Table 8). The population growth rate (λ - spawner-to-spawner ratios or cohort replacement ratios) will decrease annually by 0.0511% for the CCC steelhead.

Table 8. Static-trend Population Analysis at the Five-Year and 10-Year Intervals for CCC Steelhead at a 1% return rate.

| Species | Present Abundance Estimate | Escapement Reduction | 5-Year Escapement Reduction | Adjusted Species Estimate | Decrease in Species Productivity | 10-Year Escapement Reduction | Adjusted Species Estimate | Decrease in Species Productivity | Annual Decrease in Population Productivity |
|------------------|----------------------------------|-------------------------|-----------------------------------|---------------------------------|--|------------------------------------|---------------------------------|--|--|
| CCC steelhead | 3912* | 2.0 | 10.0 | 3902 | 0.256% | 20.0 | 3892 | 0.511% | 0.0511% |

^{*} Does not include the Russian River population.

In summary, CCC steelhead is unlikely to be at risk from increased Caspian tern predation. At the five-year interval, productivity for this species will decrease by 0.256% to 0.511% at the 10-year interval. Based on the analysis in Table 8, decreases in productivity at the five-year and 10-year intervals are unlikely to appreciably diminish productivity in the long term for CCC steelhead at the species scale.

CV steelhead. Of the 114,960 juvenile salmonids likely to be consumed on an annual basis by Caspian terns in San Francisco Bay, an estimated 371 are likely to be juvenile CV steelhead. Based on data from the CDFG (2001a and 2001b), approximately 53,248,310 hatchery-produced salmonids (excluding rainbow trout) were released into the Sacramento and San Joaquin Rivers, and various locations throughout the Delta. Based on information from CDFG, approximately 55,938,310 juvenile salmonids were produced in the Sacramento-San Joaquin basins in 1999 (CFDG 2001a and CDFG 2001b).

Based on the analysis in Appendices C and D, an annual reduction of 371 juvenile CV steelhead will result in escapement reductions of 3.71 adults at the 1% return rate to 7.42 adults at the 2% return rate. Using the static-trend population analysis, five-year and 10-year population estimates were generated (Table 9). The population growth rate (λ - spawner-to-spawner ratios or cohort replacement ratios) will decrease annually by 0.0511% for the CV steelhead species.

Table 9. Static-trend Population Analysis at the Five-Year and 10-Year Intervals for the CV Steelhead Species at a 1% return rate.

| Species | Present Abundance Estimate | Escapement Reduction | 5-Year Escapement Reduction | Adjusted Species Estimate | Decrease in Species Productivity | 10-Year Escapement Reduction | Adjusted Species Estimate | Decrease in Species Productivity | Annual Decrease in Population Productivity |
|-----------------|----------------------------------|-------------------------|-----------------------------------|---------------------------------|--|------------------------------------|---------------------------------|--|---|
| CV steelhead | 7256 | 3.71 | 18.55 | 7237 | 0.258% | 37.1 | 7219 | 0.511% | 0.0511% |

In summary, the CV steelhead species is unlikely to be at risk from increased Caspian tern predation. At the five-year interval, productivity for this species will decrease by 0.258% to 0.511% at the 10-year interval. Based on the analysis in Table 9, decreases in productivity at the five-year and 10-year intervals are unlikely to appreciably diminish productivity in the long term for CV steelhead at the species scale.

Summary of Effects of Predation. The analysis of the impact on ESA-listed salmonids assumes that the proposed Caspian tern colonies are at the maximum number of birds proposed for each habitat management site.

Effects of the USFWS' and the Corps' proposed Caspian Tern Management Plan to Reduce Predation of Juvenile Salmonids in the Columbia River Estuary include:

- 1. <u>UWR spring-run Chinook salmon</u>. For the UWR spring-run Chinook salmon species, an estimated 216 juveniles are reasonably certain to be taken by Caspian terns at Fern Ridge Lake on an annual basis. Based on the analysis in the Effects of the Action section, above, and compared to the current McKenzie and Middle Fork Willamette population productivity indices, the magnitude of take estimated for the McKenzie and Middle Fork Willamette populations will reduce abundance and productivity, however the magnitude and intensity of reduction is not likely to appreciably diminish abundance and productivity in the long term for these two populations or the species.

 <u>Species Determination</u>. The magnitude of take on the UWR spring-run Chinook salmon species is not likely to reach a level that would reduce appreciably the likelihood for survival and recovery for UWR spring-run Chinook salmon.
- 2. <u>CV spring-run Chinook salmon</u>. For the CV spring-run Chinook salmon species, an estimated 311 juveniles are reasonably certain to be taken by Caspian terns in San Francisco Bay on an annual basis. Based on the analysis in the Effects of the Action section, above, and compared to current species productivity indices, the magnitude of take estimated for CV spring-run Chinook salmon will reduce abundance and productivity, however the magnitude and intensity of reduction is not likely to appreciably diminish abundance and productivity in the long term for the species.

<u>Species Determination</u>. The magnitude of take on the CV spring-run Chinook salmon species is not likely to reach a level that would reduce appreciably the likelihood for survival and recovery for CV spring-run Chinook salmon.

- 3. SR winter-run Chinook salmon. For the SR winter-run Chinook salmon species, an estimated 30 juveniles are reasonably certain to be taken by Caspian terns in San Francisco Bay on an annual basis. Based on the analysis in the Effects of the Action section, above, and compared to current species productivity indices, the magnitude of take estimated for SR winter-run Chinook salmon will reduce abundance and productivity, however the magnitude and intensity of reduction is not likely to appreciably diminish abundance and productivity in the long term for the species.

 Species Determination. The magnitude of take on the SR winter-run Chinook salmon species is not likely to reach a level that would reduce appreciably the likelihood for survival and recovery for SR winter-run Chinook salmon.
- 4. <u>CCC steelhead</u>. For the CCC steelhead species, an estimated 200 juveniles are reasonably certain to be taken by Caspian terns in San Francisco Bay on an annual basis. Based on the analysis in the Effects of the Action section, above, and compared to current species productivity indices, the magnitude of take estimated for CCC steelhead will reduce abundance and productivity; however the magnitude and intensity of reduction is not likely to appreciably diminish abundance and productivity in the long term for the species.

<u>Species Determination</u>. The magnitude of take on the CCC steelhead species is not likely to reach a level that would reduce appreciably the likelihood for survival and recovery for CCC steelhead.

5. <u>CV steelhead</u>. For the CV steelhead species, an estimated 371 juveniles are reasonably certain to be taken by Caspian terns in San Francisco Bay on an annual basis. Based on the analysis in the Effects of the Action section, above, and compared to current species productivity indices, the magnitude of take estimated for CV steelhead will reduce abundance and productivity, however the magnitude and reduction of reduction is not likely to appreciably diminish abundance and productivity in the long term for the species.

<u>Species Determination</u>. The magnitude of take on the CV steelhead species is not likely to reach a level that would reduce appreciably the likelihood for survival and recovery for CV steelhead.

Reduction in Forage Species. Relocation of Caspian terms will result in a reduction in forage species availability for rearing and migrating juvenile ESA-listed salmonids considered in this Opinion. Based on diet composition, Caspian terms are likely to consume an annual total of 600,000 fish at the Fern Ridge Lake site. In San Francisco Bay, Caspian terms are likely to consume an annual total of 6,919,953 fish.

In addition to a diet dominated by macroinvertebrates, juvenile salmonids consume fish as part of their diet, especially fish in the 1+ to 4+ age classes, although fish consumption typically occurs in estuarine habitats. Larger juvenile salmonids, e.g., two- to four-year old steelhead, are more likely to consume a higher percentage of fish as part of their diet than younger juvenile salmonids, including fishes preferred by Caspian terns (e.g., anchovy). Therefore, it is likely that the proposed action will result in a reduction in forage species for juvenile salmonids. However, NMFS does not expect reductions in prey availability to be of a magnitude that would reduce appreciable food resources for juvenile ESA-listed salmonids in the Columbia River estuary or San Francisco Bay.

Effects on Critical Habitat

The proposed action will affect designated critical habitat for UWR spring-run Chinook salmon, CV spring-run Chinook salmon, SR winter-run Chinook salmon, CCC steelhead, and CV steelhead. These effects are limited to food resources (biological element) that are among the freshwater spawning and rearing sites and estuarine areas. The proposed action is unlikely to have affects on other PCEs for designated critical habitat for UWR spring-run Chinook salmon, CV spring-run Chinook salmon, SR winter-run Chinook salmon, CCC steelhead, and CV steelhead. The adverse effects on designated critical habitat will be long-term, negative effects to the conservation value of designated critical habitat.

Effects on juvenile forage from the loss (temporal and spatial) of freshwater and marine fishes will affect juvenile (supporting growth and maturation) salmonids related to freshwater rearing sites and estuarine areas for designated critical habitat within the four action areas.

Relocation of Caspian terms will result in a reduction in forage species availability, including for rearing and migrating juvenile salmonids considered in this Opinion. Based on diet composition, Caspian terms are likely to consume an annual total of 600,000 fish at the Fern Ridge Lake site. In San Francisco Bay, Caspian terms are likely to consume an annual total of 6,919,953 fish.

In addition to a diet dominated by macroinvertebrates, juvenile salmonids consume fish as part of their diet, especially fish in the 1+ to 4+ age classes, although fish consumption typically occurs in estuarine habitats. Larger juvenile salmonids, e.g., two- to four-year old steelhead, are more likely to consume a higher percentage of fish as part of their diet than younger juvenile salmonids, including fishes preferred by Caspian terns (e.g., anchovy). Therefore, it is likely that the proposed action will result in a reduction in forage species for juvenile salmonids. However, NMFS does not expect reductions in prey availability to be of a magnitude that would reduce appreciable food resources for juvenile ESA-listed salmonids in the Columbia River estuary or San Francisco Bay.

With the implementation of this action, critical habitat for juvenile salmonids in the Columbia River estuary and San Francisco Bay would remain functional to serve the conservation value for these species. Fern Ridge Lake is not accessible to UWR spring-run Chinook salmon due to fish passage barriers. Caspian terns are likely to consume fishes primarily from Fern Ridge Lake, and

secondarily from the Willamette River. Furthermore, the diet of juvenile UWR spring-run Chinook salmon in the Willamette River and it tributaries is comprised of macroinvertebrates, not fishes. The resulting impact from this action on the PCE forage will have an insignificant affect the PCE forage and therefore the PCE would remain functional to serve the conservation role for these species.

Summary of Effects on Designated Critical Habitat. Based on diet composition, Caspian terns are likely to consume an annual total of 600,000 fish at the Fern Ridge Lake habitat management site. In the Columbia River estuary, the reduction of Caspian terns will result in a reduction of marine fish consumed by Caspian terns, increasing the forage base of marine fishes for juvenile UWR spring-run Chinook salmon. In San Francisco Bay, Caspian terns are likely to consume an annual total of 6,919,953 fish. While the magnitude of fish consumed as a result of the proposed action will reduce forage species for ESA-listed salmonids (San Francisco Bay), NMFS has determined that the impact on freshwater and marine fishes that serve as forage species for ESA-listed salmonids is spatially limited and will not considerably reduce the capability of designated critical habitat to the extent where it would appreciably diminish the PCE forage required for recovery or appreciably reduce the conservation value of designated critical habitat for UWR spring-run Chinook salmon, CV spring-run Chinook salmon, SR winter-run Chinook salmon, CCC steelhead, or CV steelhead.

Cumulative Effects

Cumulative effects are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Cumulative effects that reduce the capacity of ESA-listed species to meet their biological requirements in the action area increase the risk to the species that the effects of the proposed action on each species or its habitat will result in jeopardy (NMFS 1999).

Non-federal activities within the action areas are likely to increase with projected increases in the human population of Lane County, Oregon, and Alameda and Contra Costa Counties in California (Table 10). Thus, NMFS assumes that future private and state actions will continue within the action areas, increasing as population density rises. As the human population in the action area continues to grow, demand for agricultural, commercial, or residential development is also likely to grow. The effects of new development caused by that demand are likely to further reduce the conservation value of the habitat within the action area.

Although quantifying an incremental change in survival for the species considered in this consultation due to the cumulative effects is not possible, it is reasonably likely that some of those effects within the four action areas will be negative.

Table 10. Past and projected human population increases in counties in the action area.

| | Percent population increase April 1, 2000 – July 1, 2003 ⁽¹⁾ | Percent projected population increase 2000-2020 |
|--------------|--|---|
| Lane County | 2.3 | 26.7 ⁽¹⁾ |
| Contra Costa | 5.5 | 39.0 ⁽²⁾ |
| Alameda | 4.8 | 28.5 (3) |

(1) Lane County, Oregon: http://www.census.gov/popest/counties/tables/CO-EST2003-01-41.xls.

Contra Costa and Alameda counties, California: http://www.census.gov/popest/counties/tables/CO-EST2003-01-06.xls

Conclusion

After reviewing the status of UWR spring-run Chinook salmon, SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCC steelhead, and CV steelhead and their critical habitats, the environmental baseline for the action areas, the effects of the proposed action, and cumulative effects, NMFS concludes that the action, as proposed, is not likely to jeopardize the continued existence of these species and is not likely to destroy or adversely modify or designated critical habitat for these species. These conclusions are based on the following considerations.

A very small proportion of the total number of juvenile UWR spring-run Chinook salmon, SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCC steelhead, and CV steelhead individuals will be killed due to predation. This is because the populations are well-distributed throughout their ranges in the Willamette River basin and San Francisco Bay. For UWR spring-run Chinook salmon in particular, these adverse effects will be somewhat offset by the reduction in their predation by Caspian terms in the Columbia River estuary. The magnitude of take on juvenile salmonids is well below the level to produce an appreciable effect on the abundance, distribution, diversity, and productivity of these species at either the population or species scale.

The adverse effects of the proposed action on designated critical habitats for the forage PCE for UWR spring-run Chinook salmon, SR winter-run Chinook salmon, CV spring-run Chinook salmon, CCC steelhead, and CV steelhead will be long-term. However, the effects of predation and the loss of forage species are unlikely to be of a magnitude or extent that would appreciably diminish growth and development of juvenile salmonids in the action area or at the species scale. Therefore, with implementation of the action, critical habitats would remain functional to serve the conservation role for the species.

Cumulative effects anticipated from future state or private activities within the action areas are likely to increase the conservation value of some critical habitat PCEs and decrease the value of others, causing no discernable change in the condition or trend of habitat conservation value or the survival of individual fish.

⁽²⁾ http://egov.oregon.gov/DAS/QEA/docs/demographic/co_pop.doc (Oregon Office of Economic Analysis, State of Oregon LONG TERM POPULATION & EMPLOYMENT FORECASTS FOR OREGON STATE AND COUNTY TOTAL POPULATIONS Release date: January 1997)

⁽³⁾ http://www.dof.ca.gov/HTMU/DEMOGRAP/DRU_Publications/Projections/P3/CONTRA%20COSTA.XLS. State of California, Department of Finance, Population Projections by Race/Ethnicity, Gender and Age for California and Its Counties 2000-2050, Sacramento, California, May 2004.

Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary measures suggested to minimize or avoid adverse effects of a proposed action on ESA-listed species, to minimize or avoid adverse modification of critical habitats, or to develop additional information. The following conservation recommendations are consistent with these obligations, and therefore should be carried out by the USFWS and the Corps for the proposed action:

- 1. The USFWS and the Corps should continue to pursue Caspian tern relocation efforts to geographic areas that do not have ESA-listed freshwater and marine fishes.
- 2. The USFWS and the Corps should initially create Caspian tern habitat only at Don Edwards NWR and at the Hayward Regional Shoreline facility as proposed. If Caspian terns use these areas as predicted in the FEIS within three years upon habitat creation, then no additional habitat should be created at Brooks Island. Instead, additional nesting habitat at either or both of the two south San Francisco Bay sites, or an alternative inland site at least 35 miles from San Francisco Bay/Delta complex, shall be created to compensate for habitat that would have been created at Brooks Island.

Please notify NMFS if the USFWS and the Corps carry out any of these recommendations so that we will be kept informed of actions that minimize or avoid adverse effects, and those that benefit ESA-listed salmonids or their habitats.

Reinitiation of Consultation

Reinitiation of formal consultation is required and shall be requested by the Federal Action Agencies or by NMFS where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (1) The amount or extent of taking specified in the incidental take statement is exceeded, or is expected to be exceeded; (2) new information reveals effects of the action may affect listed species in a way not previously considered; the action is modified in a way that causes an effect on listed species that was not previously considered; or (3) a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16). The USFWS and the Corps shall reinitiate consultation if the monitoring reports required (see term and condition 1) are not submitted to NMFS by December 31st for a given year.

If the Federal Action Agencies fail to provide specified monitoring information annually by December 31, NMFS may consider that a modification of the action that causes an effect on listed species not previously considered and cause the Incidental Take Statement of the Opinion to expire. Moreover, unless extended through reinitiation, this Incidental Take Statement will expire 10 years after it is issued. To reinitiate consultation, contact the Habitat Conservation Division (Oregon State Habitat Office) of NMFS, and refer to NMFS No.: 2005/00124.

Incidental Take Statement

Section 9(a)(1) of the ESA prohibits the taking of listed species without a specific permit or exemption. Protective regulations adopted pursuant to section 4(d) extend the prohibition to threatened species. Among other things, an action that harasses, wounds, or kills an individual of an ESA-listed species or harms a species by altering habitat in a way that significantly impairs its essential behavioral patterns is a taking (50 CFR 222.102). Incidental take refers to takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(o)(2) exempts any taking that meets the terms and conditions of a written incidental take statement from the taking prohibition.

Amount or Extent of Take

Based on the analysis of effects of predation, as discussed in the Effects of the Action section above, predation-related take is limited to an annual maximum of 1,128 juvenile ESA-listed salmonids. This amount of take is limited by species as identified in Table 11.

Table 11. Annual Juvenile ESA-listed Salmonid Take Limitations

| Species | Annual Take Limitations |
|-------------------------------|-------------------------|
| UWR spring-run Chinook salmon | 216 |
| CV spring-run Chinook salmon | 311 |
| SR winter-run Chinook salmon | 30 |
| CCC steelhead | 200 |
| CV steelhead | 371 |

The amount of take authorized in this Opinion does not require the USFWS and the Corps to distinguish salmonids as Federally-listed or not. Instead incidental take will be determined by using the following surrogates: (1) The increase in the Caspian tern population, (2) Caspian tern productivity, (3) the season average fish consumption rate, and (4) the percent of salmonids in Caspian tern diet at each habitat management site considered in this Opinion. This amount of take is based on a maximum increase in the Caspian tern population of 600 birds at Fern Ridge Lake, 3,000 birds at Brooks Island, and 3,000 birds at Hayward Regional Shoreline and 3,000 birds at Don Edwards NWR. Should these limits be exceeded, the reinitiation provisions of this Opinion apply.

Reasonable and Prudent Measures

Reasonable and prudent measures are non-discretionary measures to avoid or minimize take that must be carried out by cooperators for the exemption in section 7(o)(2) to apply. The USFWS and the Corps has the continuing duty to regulate the activities covered in this incidental take statement where discretionary Federal involvement or control over the action has been retained or is authorized by law. The protective coverage of section 7(o)(2) may lapse if the USFWS and the Corps fails to exercise its discretion to require adherence to terms and conditions of the

incidental take statement, or to exercise that discretion as necessary to retain the oversight to ensure compliance with these terms and conditions. Similarly, if any applicant fails to act in accordance with the terms and conditions of the incidental take statement, protective coverage may lapse.

The NMFS believes that full application of conservation measures included as part of the proposed action, together with use of the reasonable and prudent measures and terms and conditions described below, are necessary and appropriate to minimize the likelihood of incidental take of ESA-listed species due to completion of the proposed action.

The USFWS and the Corps shall:

1. Implement a comprehensive monitoring and reporting program to assess the impact of predation by Caspian terms on ESA-listed salmonids considered in this Opinion from implementation of habitat management activities by the USFWS and the Corps.

Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, the USFWS and the Corps must fully comply with conservation measures described as part of the proposed action and the following terms and conditions that implement the reasonable and prudent measures described above. Partial compliance with these terms and conditions may invalidate this take exemption, result in more take than anticipated, and lead NMFS to a different conclusion regarding whether the proposed action will result in jeopardy or the destruction or adverse modification of critical habitats.

- 1. To implement Reasonable and Prudent Measure #1 (monitoring and reporting program), The USFWS and the Corps shall:
 - a. Submit a monitoring report to NMFS by December 31st of a given year. The monitoring report will include the following information.
 - b. Project identification.
 - i. Project name.
 - ii. USFWS and Corps contact persons.
 - iii. Geographic location.
 - iv. Monitoring start and end dates at each site considered in this Opinion.
 - v. Provide a copy of all monitoring results associated with the proposed conservation measures.
 - c. Annually record and provide a copy of the report to NMFS on the size of each Caspian tern colony over the entire nesting period considered in this Opinion.
 - d. To monitor the impact of incidental take and to ensure that the amount of take authorized in this Opinion is not exceeded, record and provide a copy of the report to NMFS, on fish consumption rates and the diet composition of Caspian terns at

each habitat management site over the entire nesting period identified in this Opinion.

- i. At each habitat management site considered in this Opinion, the requirement to collect data on fish consumption rates and diet composition shall occur once the predicted maximum colony size increases to 75% of the projected number of Caspian terms identified in the this Opinion, and is only required after a given Caspian term colony meets the 75% threshold for two consecutive years.
- ii. Data on Caspian tern diet composition (all fishes) shall be collected at least once a week at each habitat management site.
- iii. Record the number of salmonids (bill loads) brought to the nesting site each day of observation.
 - (1) To the extent practicable, salmonids shall be identified to the species level. Species-specific anatomical characteristics used in identifying each salmonid shall be recorded.
 - (2) To the extent practicable, record the estimated length of each salmonid brought to the nesting sites.
- iv. Fish consumption rate and diet composition monitoring may cease after three consecutive years of data collection provided the assumptions regarding fish consumption rates and diet composition (percent salmonids in the diet) are less than those considered in this Opinion.
- e. Submit monitoring reports to:

State Director
Oregon State Habitat Office
Attn: 2005/00124
1201 NE Lloyd Boulevard, Suite 1100
Portland, OR 97232-2778

MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

The consultation requirements of section 305(b) MSA directs Federal agencies to consult with NMFS on all actions, or proposed actions, that may adversely affect EFH. Adverse effects include the direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside EFH, and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that may be taken by the action agency to conserve EFH.

The Pacific Fishery Management Council designated EFH for groundfish (PFMC 1998a), coastal pelagic species (PFMC 1998b), and Chinook salmon and coho salmon (PFMC 1999). The

proposed action and action area for this consultation are described in the Introduction to this document. The action area includes areas designated as EFH for various life-history stages of Pacific Coast groundfish (PFMC 1998a), coastal pelagic species (PFMC 1998b), and Pacific Coast salmon (PFMC 1999) (Table 12). The effects of the proposed action on EFH are as follows.

The proposed action will adversely affect abundance of freshwater and marine fishes that serve as prey species for Chinook salmon, coho salmon, groundfish species, and coastal pelagic species identified in Table 12 of this document.

EFH Conservation Recommendations

The NMFS believes that the following conservation measure is necessary to avoid, mitigate, or offset the impact that the proposed action has on EFH.

- 1. Record and report, annually, the size of each Caspian tern colony over the entire nesting period considered in this consultation to assess the impact on forage species for Chinook salmon and coho salmon.
- 2. Record and report, annually, by species, the diet composition of Caspian terms at each site considered in this consultation to assess the impact on forage species for Chinook salmon and coho salmon.
- 3. The USFWS and the Corps should initially create Caspian tern habitat only at Don Edwards NWR and at the Hayward Regional Shoreline facility as proposed to minimize the impact of the proposed action on designated EFH (forage species). If Caspian terns use these areas as predicted in the FEIS within three years upon habitat creation, then no additional habitat shall be created at Brooks Island. Instead, additional nesting habitat at either or both of the two south San Francisco Bay sites, or an alternative inland site at least 35 miles from San Francisco Bay, shall be created to compensate for habitat that would have been created at Brooks Island. The adaptive management plan shall be approved by NMFS prior to any habitat development other than that proposed for Don Edwards NWR and Hayward Regional Shoreline.

Statutory Response Requirement

Federal agencies are required to provide a detailed written response to NMFS' EFH conservation recommendations within 30 days of receipt of these recommendations [50 CFR 600.920(j)(1)]. The response must include a description of measures proposed to avoid, mitigate, or offset the adverse affects that the activity has on EFH. If the response is inconsistent with the EFH conservation recommendations, the response must explain the reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects.

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, in your statutory reply to the EFH portion of this consultation, we ask that you clearly identify the number of conservation recommendations accepted.

Supplemental Consultation

The USFWS and the Corps must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH conservation recommendations [50 CFR 600.920(k)].

Table 12. Species with Designated EFH in the Estuarine EFH Composite in the States of Oregon and California

| Groundfish Species | | Groundfish Species | |
|-------------------------|-------------------------|-----------------------|--|
| Leopard Shark | Triakis semifasciata | Tiger Rockfish | Sebastes nigrocinctus |
| Soupfin Shark | Galeorhinus zyopterus | Vermillion Rockfish | Sebastes miniatus |
| Spiny Dogfish | Squalus acanthias | Yellowtail Rockfish | Sebastes reedi |
| California Skate | Raja inornata | Arrowtooth Flounder | Atheresthes stomias |
| Spotted Ratfish | Hydrolagus colliei | Butter Sole | Isopletta isolepis |
| Lingcod | Ophiodon elongatus | Curlfin Sole | Pleuronichthys decurrens |
| Cabezon | Scorpaenichthys | Dover Sole | Microstomus pacificus |
| Kelp Greenling | Hexagrammos | Flathead Sole | Hippoglossoides elassodon |
| Pacific Cod | Gadus macrocephalus | Petrale Sole | Eopsetta jordani |
| Pacific Whiting (Hake) | Merluccius productus | Sand Sole | Psettichthys melanostictus |
| Black Rockfish | Sebastes maliger | Longnose Skate | Raja rhina |
| Bocaccio | Sebastes paucispinis | Sablefish | Anoplopoma fimbria |
| Brown Rockfish | Sebastes auriculatus | Canary Rockfish | Sebastes pinniger |
| Copper Rockfish | Sebastes caurinus | China Rockfish | Sebastes nebulosus |
| Quillback Rockfish | Sebastes maliger | Darkblotched Rockfish | Sebastes crameri |
| English Sole | Pleuronectes vetulus | Greenstriped Rockfish | Sebastes elongatus |
| Pacific Sanddab | Citharichthys sordidus | Big Skate | Raja binoculata |
| Rex Sole | Glyptocephalus zachirus | Starry Flounder | Platichthys stellatus |
| Rosy Rockfish | Sebastes rosaceus | Rock Sole | Lepidopsetta bilineata |
| Rougheye Rockfish | Sebastes aleutianus | Pacific Ocean Perch | Sebastes alutus |
| Sharpchin Rockfish | Sebastes zacentrus | Redbanded Rockfish | Sebastes babcocki |
| Shortspine Thornyhead | Sebastolobus alascanus | Redstripe Rockfish | Sebastes proriger |
| Stripetail Rockfish | Sebastes saxicola | Rosethorn Rockfish | Sebastes helvomaculatus |
| | 化催化剂剂 生物末端 | | |
| Coastal Pelagic Species | | | |
| Pacific Sardine | Sardinops sagax | | |
| Pacific (Chub) Mackerel | Scomber japonicus | | |
| Northern Anchovy | Engraulis mordax | | |
| Jack Mackerel | Trachurus symmetricus | | |
| California Market Squid | Loligo opalescens | , | |
| | Succession Property in | to a facility and su | c spillspirginglig the adherence of the commit |
| Pacific Salmon Species | | | |
| Chinook Salmon | Oncorhyncus tshawytcha | | |
| Coho Salmon | Oncorhyncus kisutch | | |

DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) (Data Quality Act) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the Opinion addresses these Data Quality Act (DQA) components, documents compliance with the DQA, and certifies that this Opinion has undergone pre-dissemination review.

Utility: This document records the results of an interagency consultation. The information presented in this document is useful to the USFWS, the Corps, NMFS, and the general public. These consultations help to fulfill multiple legal obligations of the named agencies. The information is also useful and of interest to the general public as it describes the manner in which public trust resources are being managed and conserved. The information is beneficial to citizens in the states of Oregon and California because the underlying project affects natural resources throughout each state. The information presented in these documents and used in the underlying consultations represents the best available scientific and commercial information and has been improved through interaction with the consulting agency.

Individual copies were provided to the above-listed entities. This consultation will be posted on NMFS' Northwest Region website (http://www.nwr.noaa.gov). The format and naming adheres to conventional standards for style.

Integrity: This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

Objectivity:

Information Product Category: Natural Resource Plan.

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA Regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.920(j).

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the Literature Cited section. The analyses in this Opinion/EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with Northwest Region ESA quality control and assurance processes.

LITERATURE CITED

- BRT (West Coast Salmon Biological Review Team). 2003. Updated status of Federally listed ESUs of West Coast salmon and steelhead. U. S. Department of Commerce, National Marine Fisheries Service, Northwest Fisheries Science Center and Southwest Fisheries Science Center (July). http://www.nwr.noaa.gov/AlseaResponse/20040528/brtusr.html
- CDFG (California Department of Fish and Game). 2001a. Report of the subcommittee on off-site release and straying of hatchery-produced Chinook salmon.
- CDFG and National Marine Fisheries Service (NMFS). 2001b. Joint hatchery review committee. Final report an anadromous salmonid fish hatcheries in California.
- Corps (U.S. Army Corps of Engineers), U.S. Bureau of Reclamation, and the Bonneville Power Administration (2004). Final Updated proposed action for the FCRPS biological opinion remand.
- Firman, J., M. Buckman, R. Schroeder, K. Kenaston, M. Hogansen, and B. Cannon. 2005. Work completed for compliance with the biological opinion for hatchery programs in the Willamette basin, USACE funding: 2004. 83 p.
- Groot, C. and L. Margolis. 1991. Pacific Salmon Life Histories. UBC Press, Vancouver, Canada. 564 p.
- McElhany, P., M. Ruckleshaus, M. J. Ford, T. Wainwright, and E. Bjorkstedt. 2000. Viable Salmon Populations and the Recovery of Evolutionarily Significant Units. U. S. Department of Commerce, National Marine Fisheries Service, Northwest Fisheries Science Center, NOAA Technical Memorandum NMFS-NWFSC-42. 156 p. http://www.nwfsc.noaa.gov/publications/techmemos/tm42/tm42.pdf
- McElhany, P., T. Backman, C. Busack, S. Kolmes, J. Myers, D. Rawding, A. Steel, C. Steward, T. Whitesel, and C. Willis. 2004. Status evaluation of salmon and steelhead populations in the Willamette and lower Columbia basins. Willamette/Lower Columbia Technical Recovery Team. NMFS, Northwest Fisheries Science Center, Seattle, WA. July.
- NMFS 1999b. The Habitat Approach. Implementation of Section 7 of the Endangered Species Act for Actions Affecting the Habitat of Pacific Anadromous Salmonids. Northwest Region, Habitat Conservation and Protected Resources Divisions, Portland, Oregon (August 26).

- NMFS 2000. Endangered Species Act Section 7 consultation and Magnuson-Stevens Act essential fish habitat consultation: Biological opinion on reinitiation of consultation on operation of the Federal Columbia River Power System, including the juvenile fish transportation program, and 19 Bureau of Reclamation projects in the Columbia basin. National Marine Fisheries Service, Portland, OR. December 21.
- NMFS 2003. Endangered Species Act Section 7 consultation and Magnuson-Stevens Act essential fish habitat consultation for the Benicia-Martinez New Bridge Project (151422SWR02SR6292:GRS). National Marine Fisheries Service. Long Beach, CA.
- NMFS 2004a. Biological Opinion: Operation of the Federal Columbia River Power System, Including the 19 Bureau of Reclamation Projects in the Columbia Basin. NOAA Fisheries, Northwest Region, Seattle, WA.
- NMFS 2004b. Salmonid hatchery inventory and effects evaluation report: An evaluation of the effects of artificial propagation on the status and likelihood of extinction of West Coast salmon and steelhead under the Federal Endangered Species Act. National Marine Fisheries Service. Portland, OR.. May 28. Available at: http://www.nwr.noaa.gov/1srd/Prop_Determins/Inv_Effects_Rpt/
- NRC (National Research Council). 1996. Upstream—Salmon and Society in the Pacific Northwest. National Academy Press, Washington, D.C. 452 p.
- ODEQ (Oregon Department of Environmental Quality). 2002. Oregon's Final 303(d) List.
- ODEQ (Oregon Department of Environmental Quality). Water Quality Division. July 2004. Oregon's 2004 Water Quality Assessment Section 305(b) Report.
- ODFW 2004. Willamette hatchery operations plan 2004. p.18.
- PFMC (Pacific Fishery Management Council). 1998a. Final Environmental Assessment/
 Regulatory Review for Amendment 11 to the Pacific Coast Groundfish Fishery
 Management Plan. Pacific Fishery Management Council, Portland, Oregon (October).
 http://www.pcouncil.org/groundfish/gffmp/gfall.html
- PFMC 1998b. The Coastal Pelagic Species Fishery Management Plan: Amendment 8. Pacific Fishery Management Council, Portland, Oregon (December). http://www.pcouncil.org/cps/cpsfmp.html
- PFMC 1999. Amendment 14 to the Pacific Coast Salmon Plan. Appendix A: Description and Identification of Essential Fish Habitat, Adverse Impacts and Recommended Conservation Measures for Salmon. Pacific Fishery Management Council, Portland, Oregon (March). http://www.pcouncil.org/salmon/salfmp/a14.html

- Roby, D.D., K. Collis, S.K. Nelson, K. Larsen, and K. Bixler. 2004. Caspian tern nesting ecology and diet in San Francisco Bay and Dungeness National Wildlife Refuge. 2004 Final Annual Report. U.S. Fish and Wildlife Service unpublished report, Portland, OR, 51 p.
- Spence, B.C, G.A. Lomnicky, R.M. Hughes, R.P. Novitzki. 1996. An Ecosystem Approach to Salmonid Conservation. TR-4501-96-6057. ManTech Environmental Research Services Corp., Corvallis, Oregon. (December).
- WDFW 2002. Total salmon production by state hatcheries (all species).
- WDFW 2003. SaSI (Salmon and Steelhead Inventory). 2003. Salmon and steelhead inventory—2002. WRIAs 1, 3, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17 and 18. Fish Program, Science Division. Washington Department of Fish and Wildlife. Olympia, WA.
- USFWS 2005a. Caspian tern management to reduce predation of juvenile salmonids in the Columbia River Estuary, Final Environmental Impact Statement. Portland, OR.
- USFWS 2005b. Biological assessment for the Caspian tern management to reduce predation of juvenile salmonids in the Columbia River estuary.

APPENDIX A - Impact Methodologies for ESA-listed Salmonids

Fern Ridge Lake

For UWR spring-run Chinook salmon a single methodology was used. The description below is for McKenzie population. For the Middle Fork Willamette population, replace the values in row 4 with the values in row 6 in Appendix B.

Column A

Species and populations.

Column B

Maximum increase of individual Caspian terns proposed.

Column C

The seasonal average fish consumption rate for a given season.

Column D

The average salmonid consumption rate by Caspian terns. This was generated by taking the percent of salmonids in the Caspian tern diet provided in the BA of 26% dividing it by seven (number of available prey species) divided by 100 to derive a percentage.

Column E

The average productivity rate for adult Caspian terns.

Column F

This was calculated by taking the value in cell B4 divided by 2 and multiplied by the value in cell E4.

Column G

This was calculated by taking the value in cell I4 divided by the total salmonid productivity index for the Willamette River in 2004.

Column H

This was calculated by taking the value in cell G4 multiplied by the value in cell D4.

Column I

This was calculated by taking the value in cell B4 multiplied by the value in cell C4 times the value in cell D4.

Column J

This was calculated by taking the total estimated juvenile salmonid productivity index in the Willamette River divided by the total number of fish consumed during the nesting period.

Column K

This was calculated by taking the value in cell I4 divided by the value in cell J4 multiplied by the value in cell H4.

Column L

This was calculated by taking the value in cell K4 multiplied by the value in cell P4 divided by the value in cell O4 then multiplied by 6 (number of extant UWR spring-run Chinook salmon populations) to derive a population-relative coefficient.

Column M

These values are based on the BRT 2003 arithmetic maximum estimates.

Column N

These values are based on the BRT 2003 arithmetic maximum estimates.

Column O

This was calculated by taking the value in cell N4 multiplied by the average salmonid smolt-torun production indices generated in the Puget Sound over a 17-year period. This index was generated from available data in the Washington Department of Fish and Wildlife (WDFW) 2002 SASI reports (2003).

Column P

This was calculated by taking the value in cell O4 and subtracting the value in cell L4.

Column Q

This was calculated by taking the value in cell P4 multiplied by 1%.

Column R

This was calculated by taking the value in cell P4 multiplied by 2%.

Column S

This was calculated by taking the value in cell O4 multiplied by 1% and subtracting the value in cell Q4.

Column T

This was calculated by taking the value in cell O4 multiplied by 2% and subtracting the value in cell R4.

Column U

This was calculated by taking the value in cell S4 multiplied by 5 (years) and divided by the value in cell in N4 then multiplied by 100 to derive a percentage.

Column V

This was calculated by taking the value in cell S4 multiplied by 10 (years) divided by the value in cell N4 then multiplied by 100 to derive a percentage.

Brooks Island

For CV spring-run Chinook salmon, SR winter-run Chinook salmon, CCC steelhead and CV steelhead a single methodology was used. The description below is for CV spring-run Chinook salmon. For SR winter-run Chinook salmon, CCC steelhead, and CV steelhead, replace the values in row 4 with the values in rows 6, 8 and 10, respectively in Appendix D. Rows 12 and 14 are for fall Chinook salmon and hatchery salmonids (excluding fall Chinook salmon and rainbow trout), respectively.

Column A

Species.

Column B

Maximum increase of individual Caspian terns proposed.

Column C

The seasonal average fish consumption rate for a given season.

Column D

The average salmonid consumption rate by Caspian terns.

Column E

This was calculated by taking the value in cell B4 multiplied by the value in cells C4 and D4.

Column F

The average productivity rate for Caspian terns at the San Francisco Bay sites.

Column G

This was calculated by taking the value in cell B4 divided by 2 and multiplied by the value in cell H4.

Column H

This was calculated by taking the value in cell B4 multiplied by the value in cell C4 times the value in cell D4.

Column I

These values are based on the BRT 2003 arithmetic maximum estimates.

Column J

This was calculated by taking the value in cell L4 divided by the value in cell L15 multiplied by 100 to derive a relative abundance estimate.

Column K

This was calculated by taking the value in cell L4 multiplied by the value in cell H4 divided by 100 to derive a relative take estimate.

Column L

This was calculated by taking the value in cell I4 multiplied by the average salmonid smolt-torun production indices generated in the Puget Sound. This was an index generated by available data from the WDFW 2002 SASI report.

Column M

This was calculated by taking the value in cell L4 subtracting the value in cell K4.

Column N

This was calculated by taking the value in cell M4 multiplied by 1%.

Column O

This was calculated by taking the value in cell M4 multiplied by 2%.

Column P

This was calculated by taking the value in cell L4 multiplied by 1% subtracting the value in cell N4.

Column Q

This was calculated by taking the value in cell L4 multiplied by 2% subtracting the value in cell N4.

Column R

This was calculated by taking the value in cell P4 multiplied by 5 (years) and divided by the value in cell in I4 then multiplied by 100 to derive a percentage.

Column S

This was calculated by taking the value in cell P4 multiplied by 10 (years) divided by the value in cell I4 then multiplied by 100 to derive a percentage.

Hayward Regional Shorelines and Don Edwards NWR

For CV spring-run Chinook salmon, CCC steelhead and CV steelhead a single methodology was used. The description below is for CV spring-run Chinook salmon. For CCC steelhead and CV steelhead, replace the values in row 4 with the values in rows 6 and 8, respectively in Appendix D. Rows 10 and 12 are for fall Chinook salmon and hatchery salmonids (excluding fall Chinook

salmon and rainbow trout), respectively. For many of the values, e.g., productivity rate, the variable is doubled to account for both Caspian tern colonies.

Column A

Species.

Column B

Maximum increase of individual Caspian terns proposed for both sites.

Column C

The season average fish consumption rate for a given season.

Column D

The average salmonid consumption rate by Caspian terns. This consumption rate was based on the Caspian tern diet composition at the Agua Vista Park colony in 2004.

Column E

This was calculated by taking the value of cell B4 multiplied by the value in cell C4 multiplied by the value in cell D4.

Column F

The average productivity rate for adult Caspian terns at the San Francisco Bay sites.

Column G

This was calculated by taking the value in cell B4 divided by 2 multiplied by the value in cell H4.

Column H

This was calculated by taking the value in cell B4 multiplied by the value in cell C4 multiplied the value in cell D4.

Column 1

These values are based on the BRT 2003 arithmetic maximum estimates.

Column J

This was calculated by taking the value in cell L4 divided by the value in cell L13 then multiplied by an abundance-reduction coefficient and multiplied by 100 to derive a relative abundance estimate.

Column K

This was calculated by taking the value in cell J4 multiplied by the value in cell H4 divided by 100 to derive a relative take estimate.

Column L

This was calculated by taking the value in cell I4 multiplied by the average salmonid smolt-torun production indices generated in the Puget Sound over a 17-year period. This index was generated from available data in the WDFW 2002 SASI reports.

Column M

This was calculated by taking the value in cell L4 subtracting the value in cell K4.

<u>Column N</u>

This was calculated by taking the value in cell M4 multiplied by 1%.

Column O

This was calculated by taking the value in cell M4 multiplied by 2%.

Column P

This was calculated by taking the value in cell L4 multiplied by the 1% subtracting the value in cell N4.

Column Q

This was calculated by taking the value in cell L4 multiplied by the 2% subtracting the value in cell N4.

Column R

This was calculated by taking the value in cell P4 multiplied by 5 (years) then divided by the value in cell in I4 and multiplied by 100 to derive a percentage.

Column S

This was calculated by taking the value in cell P4 multiplied by 10 (years) divided by the value in cell I4 then multiplied by 100 to derive a percentage.

APPENDIX B - Fern Ridge Lake

| ESU | Maximum Increase in Tern Population (Individual Birds) | Average Fish Consumption | Percent Juvenile Salmonids in Tern Diet | Caspian Ter Productivity Rate | Juveniles | Hatchery Fish Coefficient | Hatchery Fish Diet Coefficient | Total Salmonids in Diet | | Salmonid Coefficient | Populuation-level Take | ESU Escapement Estimate | Population Escapement Estimate | Smolt | Smolt Production Less Take | 1% Return | | Escapement Decrease at 1% | Escapement Decrease at 2% | Population Percent Decrease at | 10-Year Population Percent Decrease at 1% |
|-----------------------------------|--|-----------------------------|--|-------------------------------------|-----------|---------------------------------|--------------------------------------|----------------------------|---------|-------------------------|---------------------------|-------------------------------|--------------------------------------|----------|----------------------------------|-----------|--------|---------------------------------|---------------------------------|--------------------------------------|---|
| UWR Spring-run Chinook Salmon | | | - Samuelle S | | | | | | | 1.044 | | | | | | - 4 | | | | | |
| Population McKenzie | 600 | 1000 | 0.0371- | 0.7 | 3 215 | 0.00434 | 0.01609 | 22285.71429 | 1.11410 | 321.86034 | 1 180 | 5109 | 1 478 | 8 114385 | 5 114205 | 1142.05 | 2284.1 | 1.8 | 3.4 | 0.18797 | 7 0.37594 |
| Population Middle Fork Willamette | 600 | 1000 | 0.03714 | 0.7 | 3 215 | 0.00434 | 0.01609 | 22285.71429 | 1.11416 | 321.86034 | | | 1 98 | 7 23579 | 23543 | 235.43 | 470.86 | 0.36 | 0,72 | 0.18237 | 7 0.3647 |
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APPENDIX C - Brooks Island

| ESU/DPS | Maximum Increase in Tern Population (Individual Birds) | Fish Consumption | | Salmonids in | Productivity Rate | Juveniles Produced | | ESU/DPS Estimate | Relative Abundance | Relative Take | Smolt Production | | | 2% | Annual Escapement Decrease at | | 5-Year ESU/DPS Population Percent | |
|---|--|------------------|-------|--------------|----------------------|-----------------------|-------|---------------------|-----------------------|------------------|---------------------|---------------|----------|-----------|-------------------------------------|----------|--------------------------------------|---------|
| Brooks Island | | | | | | | | | | | | | ly make | | | | | |
| CV Spring-run Chinook Salmon | 920 | 1000 | 0.033 | 30360 | 0.49 | 225.4 | 30360 | 6068 | 8 0.2698 | 9 81.938642 | 144964.52 | 2 144882.5814 | 1448.820 | 6 2897.65 | 0.82 | 2 1.6- | 4 0.06757 | 0.13514 |
| SR Winter-run Chinook Salmon | 920 | 1000 | 0.033 | 30360 | 0.49 | 225.4 | 30360 | 219 | 0.0974 | 5 29.58590 | 5 52343 | 52313 | 523.13 | 3 1046.20 | 5 0.3 | 3 0.0 | 0.06846 | 0.13692 |
| CCC Steelhead | 920 | 1000 | 0.033 | 30360 | 0.49 | 225.4 | 30360 | 3912 | 2 0.1740 | 0 52.825308 | 93457.68 | 93404.85469 | 934.048 | 5 1868. | 0.53 | 1.00 | 6 0.06774 | 0.13548 |
| CV Steelhead | 920 | 1000 | 0.033 | 30360 | 0.49 | 225.4 | 30366 | 7256 | 6 0.3227 | 3 97.980683 | 3 173345.8- | 173247.8593 | 1732.479 | 9 3464.96 | 0.98 | 1.90 | 6 0.06753 | 0.13506 |
| Fall Chinook (not listed) | 920 | 1000 | 0.033 | 30360 | 0.49 | 225.4 | 30360 | 2000837 | 88.9924 | 5 27018.108 | 47800000 | 47772981.89 | 477729.8 | 8 955460 | 270.18 | 3 540.30 | 0.06752 | 0.13503 |
| Hatchery Salmonids (Excluding Fall Chinook) | 920 | 1000 | 0.033 | 30360 | 0.49 | 225.4 | 30360 | 228058 | 8 10.1434 | 8 3079,5613 | | | 54452 | 3 108905 | 30.8 | 61.59 | 0.06753 | 0.13505 |
| | | | | | | | | | | 30360 | 5371242 | l . | | | | | | |
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APPENDIX D - Hayward Regional Shoreline and Don Edwards NWR

APPENDIX D

Hayward RS and Don Edwards NWR

| ESU/DPS | Maximum Increase in Tern Population (Individual Birds) | Fish Consumption | | | | Juvenites Produced | Total Salmonids in Diet | ESU/DPS Estimate | Relative Abundance | | | Smolt Production Less Relative Take | | | | Annuai | Decrease at | 10-Year ESU/DPS Percent Decrease at 1% |
|--|--|------------------|--------|-------|------|-----------------------|-------------------------------|---------------------|-----------------------|-------------------|----------|---|---------|---------|--------|---------|-------------|---|
| Hayward Regional Shorelines and Don Edwards NWR | | | | | | | | | | | | | V | | | | | Herrick. |
| CV Spring-run Chinook Salmon | 6000 | 1000 | 0.0141 | 84600 | 0.98 | 2940 | 84600 | 6068 | 0.27015 | 228.5506 | 144965 | 5 144736 | 1447.36 | 2894.72 | 2.29 | 4.58 | 0.18869 | 0.37739 |
| CCC Steelhead | 6000 | 1000 | 0.0141 | 84600 | 0.98 | 2940 | 84600 | 3912 | 0.17417 | 147.3451 | 93458 | 93311 | 933.11 | 1866.22 | 1.47 | 2.94 | 0.18788 | 8 0.37577 |
| CV Steelhead | 6000 | 1000 | 0.0141 | 84600 | 0.98 | 2940 | 84600 | 7256 | 0.32304 | 273.2958 | 173346 | 5 173073 | 1730.73 | 3461.46 | 2.73 | 5.46 | 0.19075 | 0.37624 |
| Fall Chinook (not listed) | 6000 | 1000 | 0.0141 | 84600 | 0.98 | 2940 | 84600 | 2000837 | 89.07926 | 75361.06 | 47799996 | 47724635 | 477246 | 954493 | 753.61 | 1507.22 | 0.18832 | 0.37665 |
| Hatchery Salmonids (Excluding Fall Chinook) | 6000 | 1000 | 0.0141 | 84600 | 0.98 | 2940 | 84600 | 228058 | 10.15337 | 8589.752 84600 | | | 54397.2 | 108794 | 85.9 | 171.8 | 0.18833 | 3 0.37666 |
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